



**US Army Corps
of Engineers**

St. Paul District

**GENERAL REEVALUATION REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT**

**EAST GRAND FORKS, MINNESOTA
AND
GRAND FORKS, NORTH DAKOTA**

**Local Flood Reduction Project
RED RIVER OF THE NORTH**

November 1998

**General Evaluation Report
Pages 59 - 102**

relationships for these structures used previously at Grand Forks and East Grand Forks. The differences in damage estimates were determined. Survey results were also compared with depth-damage curves for commercial structures and contents used elsewhere in the Corps. Previous estimates of commercial structure and content damages were then revised, using the October 1997 survey results.

Damages and costs associated with the April 1997 flood were also obtained or otherwise examined in the following categories: household costs involving temporary relocations during the flood and during cleanup after the flood, from the October 1997 survey; public building and content damages, from the October 1997 survey and other sources; industrial property damage; infrastructure damages; vehicle damage; emergency response costs for both public sector and private relief agencies; and transportation disruption costs.

Other potential National Economic Development benefits associated with future with-project conditions that are at least preliminarily discussed include: flood insurance administrative cost savings; recreation benefits associated with the possibility of a "greenway" along both sides of the river inside the levees; location and intensification benefits; and advance replacement benefits.

In January 1998, the above mentioned economic analysis was completed as the initial optimization effort to identify the NED plan and to quantify the benefits and costs associated with the alternatives compared in the final screening. This analysis showed the effects of the total first costs, Interest During Construction (IDC), and operation and maintenance costs in calculation of the costs for each plan. The average annual benefits associated with each plan evaluated were also calculated -- this is a total of the damage reductions, future costs avoided, and redevelopment benefits.

It is conservative to assume that flood damages begin at East Grand Forks/Grand Forks when the Red and Red Lake Rivers rise to the point where one or more residential structures begins to be directly flooded. This is conservative because direct flooding causes damages usually even before direct basement flooding (e.g., floodwaters will need to be pumped at multiple entry points due to street manholes and porous clay sewer line openings which provide entry into the interconnected sewer system for movement of floodwaters prior to direct basement flooding). When direct flooding begins, floodwaters flow through the interconnected sanitary sewers and indirectly damage additional structures. Then, as the floodwater stage gets higher, a greater number of structures are directly flooded. This provides more floodwater entry points into the sanitary sewer system and allows greater indirect damages to occur.

A number of factors contribute to high indirect flood damages. These are listed below:

- Grand Forks and East Grand Forks both have separate storm sewer and sanitary water systems. These water systems are interconnected with many entry points (basement drains and along streets at manholes).
- The duration of flooding allows the floodwaters to back up throughout the sanitary sewer system.
- Almost all structures (residential, commercial, industrial, and public) have basements with extensive utilities and contain difficult to move, flood damageable, and costly equipment/belongings (e.g., a typical residential basement contains a furnace = \$2,500, a water heater = \$300, a washer and dryer = \$600, and furniture/carpets/wall coverings/etc. = \$1,000 to \$4,000).

SOCIAL / FINANCIAL

The evaluation and assessment of social, institutional, and local economic effects are developed in two steps. The first involves documentation of the deprivations suffered by the cities of Grand Forks and East Grand Forks and their residents as a result of the April 1997 flood (to identify the social and community impacts that could be prevented or avoided if a permanent project were in place to protect against a similar flood in the future). The second involves a comparison of most likely future conditions with respect to social and local economic effects in the two communities, depending on whether a permanent flood damage reduction project is constructed.

A critical need is to develop adequate information on social and local economic effects to fully understand the implications for recovery (or lack thereof) in the two communities if a permanent project is NOT constructed. This constitutes the base condition for establishing and comparing social and local economic effects of the "with-project" alternative(s).

Social and local economic effects are NOT included in the calculation of the project benefit-to-cost ratio, where National Economic Development benefits are documented to determine the Federal interest in a flood damage reduction project. But in this project area, given the experience of the April 1997 flood, it is essential that decision-makers fully consider information concerning social and local economic effects associated with future "without-project" and "with-project" alternatives.

The delineation of the future 100-year floodplain in the two communities, while not available at this time, is an important factor to consider. Hydrologic and hydraulic engineering analysis, incorporating the 1996 and 1997 floods, has produced an updated flood frequency analysis for the Red River at Grand Forks. The future 100-year floodplain is likely to be greatly expanded, given that the flood stage for the 1-percent chance flood event (so called "100-year event") is expected to increase on the order of 1.5 feet in an area that is very flat. A greatly expanded area within the two cities may face restrictions in future residential and commercial redevelopment, or intensification of development, unless it includes actions such as floodproofing or elevation of structures that would comply with floodplain regulations under the future "without project" condition. This has significant implications for social and local economic effects in considering alternative future without and with project conditions in the two communities.

The evaluative tool used to assess likely social and local economic effects in the Environmental Impact Statement is the "Impact Matrix Table" that is part of an environmental effects evaluation and reporting process. It includes 10 parameters covering social effects and 10 parameters covering local economic effects. These parameters help to structure research needs, organize information and data, and identify issues of importance in considering the effects of project implementation.

The firm Gulf Engineers & Consultants, Baton Rouge, Louisiana, was engaged in December 1997 to collect information and data to document the social, institutional, and local economic effects of the April 1997 flood for the letter report. The firm was also requested, within the limited time available, to conduct an initial assessment of social and economic effects by completing three impact matrix tables, with supporting explanations, for these future conditions: 1) without project; 2) with-project, in-town levee plan; and 3) with-project, split-flow

diversion plan. The firm prepared a report describing significant social and local economic issues and effects, along with discussion and comparison of alternative future conditions. The report was used to complete socioeconomic assessment portions of the GRR/EIS.

Cost Engineering

Cost engineering for this study's screening and NED optimization efforts was accomplished during the final screening of alternatives phase of plan formulation and documented in the Plan Comparison Letter Report, February 1998. For more detailed information, the comparative/preliminary cost summaries for the 50-year, 100-year, 210-year (1997 flood), and out-of-town features of split-flow diversion plans are included in the cost engineering appendix of the Supplemental Report. Those comparative cost evaluations and associated economic benefits evaluations showed that the 210-year (1997 flood) level of flood protection was the most cost-effective alternative. The cost estimates were of a level of detail to allow selection of an NED plan and of sufficient detail to allow determination of the feasibility of the plans evaluated. Corps and SEH cost engineers prepared the final screening cost estimates and established the NED plan in its initial identification. However, a detailed baseline cost estimate, referred to in the Corps of Engineers as MCACES cost estimates, for the recommended plan was finalized in July 1998 and is presented in this GRR.

After initial identification of the recommended plan in February 1998, detailed design and real estate acquisition efforts were completed that quantified the recommended plan. This revised features and lands quantity calculation is needed to complete a quality baseline cost estimate and is more detailed than had been accomplished previously. A quantified list of the major features of the recommended plan follows for each city and reach.

Major Grand Forks Area Features:

(See plates 4 through 73)

- 405 acres of fee title lands and 264 acres of temporary easements of real estate acquisition for unimproved and city owned properties (acreage does not include improved properties).
- 206 single-family homes (some are historically significant), 24 apartments, 11 condominiums, 6 businesses, RDO Food wastewater plant, and portions of the Grand Forks city water.
- 7.2 miles of in-town levees (ranging from 8 to 22 feet in height and having a 10-foot- wide levee top with 1 vertical on 3 horizontal side slopes).
- 1.0 mile of in-town road raise levees.
- 1.8 miles of tieback levees.
- 2.3 miles of road raise tieback levees.
- 1.1 miles of floodwalls.
- 0.5 mile of mechanically stabilized earth wall/levee.

- 7 road raises that cross the levee alignment.
- 8 road stoplog closure structures.
- 1 road earth closure.
- 1 railroad stoplog closure structures.
- 1 railroad earth closure structure.
- 0.6 mile of new streets.
- 9 pump stations.
- 22 gated outlets.
- 4.0 miles of new English Coulee diversion channel (ranging from 5 to 12 feet in depth and having a 30- to 60-foot bottom width with 1 vertical on 5 horizontal side slopes).
- 4.5 miles of existing English Coulee diversion channel modifications (widening bottom width to 80 feet grading 1 vertical on 5 horizontal side slopes and replacing existing drop structures near the outlet to the Red River).

Major East Grand Forks (North) Area Features:

(See plates 74 through 126)

- 177 acres of fee title and 49 acres of temporary easement real estate acquisition for unimproved and city owned properties (acreage does not include improved properties).
- 16 single-family homes and 60 apartments.
- 10 businesses.
- 10.1 miles of levees (ranging from 7.5 to 23 feet in height and having a 10-foot top width with 1 vertical on 3 horizontal side slopes).
- 1.2 miles of road raise levees.
- 0.2 mile of floodwalls.
- 0.1 mile of mechanically stabilized earth wall/levee.
- 11 road raises that cross the levee alignment.
- 6 road stoplog closure structures.
- 2 railroad stoplog closure structures.
- 5 pump stations.
- 9 gated outlets.

Major East Grand Forks (Point Area/South) Area Features:

(See plates 127 through 164)

- 153 acres of fee title and 37 acres of temporary easement real estate acquisition for unimproved and city owned properties (acreage does not include improved properties).
- 30 single-family homes.
- 6.0 miles of levees (ranging from 9.5 to 21 feet in height and having a 10-foot top width with 1 vertical on 3 horizontal side slopes).
- 0.8 mile of floodwalls.
- 8 road raises that cross the levee alignment.
- 2 road stoplog closure structures.
- 0.2 mile of new streets.
- 2 pump stations.
- 10 gated outlets.
- 1.2 miles of new Hartsville Coulee diversion channel (ranging from 18 to 20 feet in depth and having a 10-foot bottom width with 1 vertical on 7 horizontal side slopes).
- 3 drop structures near outlet to the Red River.

The detailed MCACES cost estimate for the recommended 210-year features is presented in Tables 5 through 8. The tables show the breakout of costs for the total project, the north end portion of East Grand Forks, the Point (south end) portion of East Grand Forks, and the Grand Forks portion of costs by subaccounts. All costs are shown in December 1997 dollars.

Table 5 - Grand Forks Community Cost Breakouts

PROJECT COST SUMMARY SHEET - SUBTOTAL: GRAND FORKS, ND
East Grand Forks & Grand Forks Flood Control - General Reevaluation Report

Red River of the North

Project: East Grand Forks and Grand Forks Flood Control
Location: Grand Forks, North Dakota

PREPARED BY: Mike Osterby, CEMVP-PE

REVIEWED and APPROVED BY: Michael S. Dahlquist
Chief, Cost Engineering and Specifications Section

Date: 20-Oct-98

No.	Description	Total Estimated Amount	Contingency		Estimated Amount Plus Contingency	Index Factor To 10/98	Indexed Cost To 10/98	Midpoint Of Feature Year	Index To Midpoint Factor	Fully Funded Amount	Fully Funded Contingency	Fully Funded Amount Plus Contingency
			Amount	Percent								
Grand Forks Flood Control-Grand Forks, ND												
.01	Lands and Damages	\$65,964,000	\$13,193,000	20%	\$79,157,000	0.015	\$80,344,000	Oct-2000	0.053	\$70,502,000	\$14,101,000	\$84,603,000
.02	Relocations	28,594,000	5,757,000	20%	34,351,000	0.015	\$34,866,000	Oct-2002	0.108	\$32,157,000	\$6,474,000	\$38,631,000
.09	Channels and Canals	11,925,000	2,876,000	24%	14,801,000	0.015	\$15,023,000	Oct-2002	0.108	\$13,411,000	\$3,234,000	\$16,645,000
.11	Levees and Floodwalls	25,383,000	7,310,000	29%	32,693,000	0.015	\$33,183,000	Oct-2002	0.108	\$28,546,000	\$8,221,000	\$36,767,000
.13	Pumping Plant	9,219,000	2,305,000	25%	11,524,000	0.015	\$11,697,000	Oct-2002	0.108	\$10,368,000	\$2,592,000	\$12,960,000
.30	Planning, Engineering and Design	12,514,000	1,517,000	12%	14,031,000	0.027	\$14,410,000	Oct-2000	0.080	\$13,880,000	\$1,683,000	\$15,563,000
.31	Construction Management	4,046,000	607,000	15%	4,653,000	0.027	\$4,779,000	Oct-2002	0.168	\$4,853,000	\$728,000	\$5,581,000
.32	HTRW	1,359,000	340,000	25%	1,699,000	0.015	\$1,724,000	Oct-2002	0.108	\$1,528,000	\$382,000	\$1,910,000
	Estimated Project Cost	\$159,004,000	\$33,905,000	21%	\$192,909,000		\$196,026,000			\$175,245,000	\$37,415,000	\$212,660,000

Other estimated costs not included in totals above. 3248111

.14	Recreation Facilities*	\$3,249,000	\$811,000	25%	\$4,060,000	0.015	\$4,121,000	Oct-2002	0.108	\$3,654,000	\$912,000	\$4,566,000
.18	Cultural Resource Preservation**	\$1,020,000	\$255,000	25%	\$1,275,000	0.015	\$1,294,000	Oct-2002	0.108	\$1,147,000	\$287,000	\$1,434,000

* Recreation is not part of the basic flood protection project and must be incrementally justified.

** Cultural Resource Preservation is not to be included in the B/C ratio.

1100000

Costs are based on December 1997 unit pricing.

Note: Contingencies are not applied to sunk cost in Account 30.

Table 6 - North End of East Grand Forks Cost Breakouts

PROJECT COST SUMMARY SHEET - SUBTOTAL: EAST GRAND FORKS, MN
 East Grand Forks & Grand Forks Flood Control - General Reevaluation Report

Red River of the North

Project: East Grand Forks and Grand Forks Flood Control
 Location: East Grand Forks, Minnesota

PREPARED BY: Mike Osterby, CEMVP-PE

REVIEWED and APPROVED BY: Michael S. Dahlquist

Chief, Cost Engineering and Specifications Section

Date: 20-Oct-98

No.	Description	Estimated Amount	Contingency		Estimated Amount Plus Contingency	Index Factor To 10/98	Indexed Cost To 10/98	Midpoint Of Feature Year	Index To Midpoint Factor	Fully Funded Amount	Fully Funded Contingency	Fully Funded Amount Plus Contingency
			Amount	Percent								
East Grand Forks Flood Control-East Grand Forks, MN												
.01	Lands and Damages	\$16,546,000	\$3,309,000	20%	\$19,855,000	0.015	\$20,153,000	Oct-2000	0.053	\$17,684,000	\$3,537,000	\$21,221,000
.02	Relocations	\$5,679,000	\$1,589,000	28%	\$7,268,000	0.015	\$7,377,000	Oct-2002	0.108	\$6,387,000	\$1,787,000	\$8,174,000
		5679206										
.09	Channels and Canals	\$3,323,000	\$954,000	29%	\$4,277,000	0.015	\$4,341,000	Oct-2002	0.108	\$3,737,000	\$1,073,000	\$4,810,000
		3323000										
.11	Levees and Floodwalls	\$12,574,000	\$2,821,000	22%	\$15,395,000	0.015	\$15,626,000	Oct-2002	0.108	\$14,141,000	\$3,173,000	\$17,314,000
		12577069										
.13	Pumping Plant	\$6,476,000	\$1,619,000	25%	\$8,095,000	0.015	\$8,216,000	Oct-2002	0.108	\$7,283,000	\$1,821,000	\$9,104,000
.30	Planning, Engineering and Design	\$5,715,000	\$737,000	13%	\$6,452,000	0.027	\$6,626,000	Oct-2000	0.080	\$6,339,000	\$817,000	\$7,156,000
.31	Construction Management	\$1,966,000	\$295,000	15%	\$2,261,000	0.027	\$2,322,000	Oct-2002	0.168	\$2,358,000	\$354,000	\$2,712,000
.32	HTRW	\$53,000	\$13,000	25%	\$66,000	0.015	\$67,000	Oct-2002	0.108	\$60,000	\$15,000	\$75,000
		53415										
	Estimated Project Cost	\$52,332,000	\$11,337,000	22%	\$63,669,000		\$64,728,000			\$57,989,000	\$12,577,000	\$70,566,000

Other estimated costs not included in totals above. \$2,039,136

.14	Recreation Facilities*	\$2,269,000	\$581,000	26%	\$2,850,000	0.015	\$2,893,000	Oct-2002	0.108	\$2,552,000	\$653,000	\$3,205,000
.18	Cultural Resource Preservation**	\$125,000	\$31,000	25%	\$156,000	0.015	\$158,000	Oct-2002	0.108	\$141,000	\$35,000	\$176,000

* Recreation is not part of the basic flood protection project and must be incrementally justified.

** Cultural Resource Preservation is not to be included in the B/C ratio.
 125000

Costs are based on December 1997 unit pricing.

Note: Contingencies are not applied to sunk cost in Account 30.

Table 7 - South End (Point Area) of East Grand Forks Cost Breakouts

PROJECT COST SUMMARY SHEET - SUBTOTAL: THE POINT AREA in EAST GRAND FORKS, MN
East Grand Forks & Grand Forks Flood Control - General Reevaluation Report

Red River of the North

PREPARED BY: Mike Osterby, CEMVP-PE

Project: East Grand Forks and Grand Forks Flood Control
Location: The Point Area in East Grand Forks, MN

REVIEWED and APPROVED BY: Michael S. Dahlquist
Chief, Cost Engineering and Specifications Section

Date: 20-Oct-98

No.	Description	Estimated Amount	Contingency		Estimated Amount Plus Contingency	Index Factor To 10/98	Indexed Cost To 10/98	Midpoint Of Feature Year	Index To Midpoint Factor	Fully Funded Amount	Fully Funded Contingency	Fully Funded Amount Plus Contingency
			Amount	Percent								
East Grand Forks Flood Control- The Point in East Grand Forks, MN												
.01	Lands and Damages	\$14,093,000	\$2,819,000	20%	\$16,912,000	0.015	\$17,166,000	Oct-2000	0.053	\$15,063,000	\$3,013,000	\$18,076,000
.02	Relocations	\$2,105,000	\$537,000	26%	\$2,642,000	0.015	\$2,682,000	Oct-2002	0.108	\$2,367,000	\$604,000	\$2,971,000
		2104788										
.09	Channels and Canals	\$6,433,000	\$1,319,000	21%	\$7,752,000	0.015	\$7,868,000	Oct-2002	0.108	\$7,235,000	\$1,483,000	\$8,718,000
		6432644										
.11	Levees and Floodwalls	\$12,508,000	\$3,352,000	27%	\$15,860,000	0.015	\$16,098,000	Oct-2002	0.108	\$14,067,000	\$3,770,000	\$17,837,000
		12510612										
.13	Pumping Plant	\$1,558,000	\$390,000	25%	\$1,948,000	0.015	\$1,977,000	Oct-2002	0.108	\$1,752,000	\$439,000	\$2,191,000
		1558144										
.30	Planning, Engineering and Design	\$2,866,000	\$310,000	11%	\$3,176,000	0.027	\$3,262,000	Oct-2000	0.080	\$3,179,000	\$344,000	\$3,523,000
.31	Construction Management	\$1,737,000	\$261,000	15%	\$1,998,000	0.027	\$2,052,000	Oct-2002	0.168	\$2,084,000	\$313,000	\$2,397,000
.32	HTRW	\$0	\$0		\$0	0.015	\$0	Oct-2002	0.108	\$0	\$0	\$0
	Estimated Project Cost	\$41,300,000	\$8,988,000	22%	\$50,288,000		\$51,105,000			\$45,747,000	\$9,966,000	\$55,713,000

Other estimated costs not included in totals above. 1180536

.14	Recreation Facilities*	\$1,411,000	\$358,000	25%	\$1,769,000	0.015	\$1,796,000	Oct-2002	0.108	\$1,587,000	\$403,000	\$1,990,000
.18	Cultural Resource Preservation**	\$88,000	\$22,000	25%	\$110,000	0.015	\$112,000	Oct-2002	0.108	\$99,000	\$25,000	\$124,000

* Recreation is not part of the basic flood protection project and must be incrementally justified.

** Cultural Resource Preservation is not to be included in the B/C ratio.

87500

Costs are based on December 1997 unit pricing.

Note: Contingencies are not applied to sunk cost in Account 30.

Table 8 - Total Community Cost Breakouts

TOTAL PROJECT COST SUMMARY SHEET
East Grand Forks & Grand Forks Flood Control - General Reevaluation Report

Red River of the North

PREPARED BY: Mike Osterby, CEMVP-PE

Project: East Grand Forks and Grand Forks Flood Control
 Location: Grand Forks, North Dakota and East Grand Forks, Minnesota

REVIEWED and APPROVED BY: Michael S. Dahlquist
 Chief, Cost Engineering and Specifications Section

Date: 20-Oct-98

No.	Description	Estimated Amount	Contingency		Estimated Amount Plus Contingency	Index Factor To 10/98	Indexed Cost To 10/98	Midpoint Of Feature Year	Index To Midpoint Factor	Fully Funded Amount	Fully Funded Contingency	Fully Funded Amount Plus Contingency
			Amount	Percent								
Combined Grand Forks / East Grand Forks Flood Control												
.01	Lands and Damages	\$96,603,000	\$19,321,000	20%	\$115,924,000	0.015	\$117,663,000	Oct-2000	0.053	\$103,249,000	\$20,650,000	\$123,899,000
.02	Relocations	\$36,378,000	\$7,883,000	22%	\$44,261,000	0.015	\$44,925,000	Oct-2002	0.108	\$40,911,000	\$8,865,000	\$49,776,000
.09	Channels and Canals	\$21,681,000	\$5,149,000	24%	\$26,830,000	0.015	\$27,232,000	Oct-2002	0.108	\$24,383,000	\$5,791,000	\$30,174,000
.11	Levees and Floodwalls	\$50,465,000	\$13,483,000	27%	\$63,948,000	0.015	\$64,907,000	Oct-2002	0.108	\$56,754,000	\$15,163,000	\$71,917,000
.13	Pumping Plant	\$17,253,000	\$4,314,000	25%	\$21,567,000	0.015	\$21,891,000	Oct-2002	0.108	\$19,403,000	\$4,852,000	\$24,255,000
.30	Planning, Engineering and Design	\$21,095,000	\$2,564,000	12%	\$23,659,000	0.027	\$24,298,000	Oct-2000	0.080	\$23,398,000	\$2,844,000	\$26,242,000
.31	Construction Management	\$7,749,000	\$1,163,000	15%	\$8,912,000	0.027	\$9,153,000	Oct-2002	0.168	\$9,295,000	\$1,395,000	\$10,690,000
.32	HTRW	\$1,412,000	\$353,000	25%	\$1,765,000	0.015	\$1,791,000	Oct-2002	0.108	\$1,588,000	\$397,000	\$1,985,000
Total Estimated Project Cost		\$252,636,000	\$54,230,000	21%	\$306,866,000		\$311,860,000			\$278,981,000	\$59,957,000	\$338,938,000

Other estimated costs not included in totals above.

.14	Recreation Facilities*	\$6,929,000	\$1,750,000	25%	\$8,679,000	0.015	\$8,809,000	Oct-2002	0.108	\$7,792,000	\$1,968,000	\$9,760,000
.18	Cultural Resource Preservation**	\$1,233,000	\$308,000	25%	\$1,541,000	0.015	\$1,564,000	Oct-2002	0.108	\$1,387,000	\$346,000	\$1,733,000

* Recreation is not part of the basic flood protection project and must be incrementally justified.

** Cultural Resource Preservation is not to be included in the B/C ratio.

Costs are based on December 1997 unit pricing.

Note: Contingencies are not applied to sunk cost in Account 30.

Environmental/Natural Resources

ENVIRONMENTAL RESOURCES

This section summarizes the evaluation contained in the Environmental Impact Statement (EIS) which may be found in a later section of this document. The EIS considers the potential effects of alternatives on the existing conditions of the area, predicting the future conditions that may occur with the project in place. When compared to future conditions without construction of the project, the effects of project construction and operation may be determined.

The scope of the EIS was defined with the assistance of public input. It considered the potential of the project to affect various resources, including the following:

1. Natural resources, including fishery, wildlife, vegetation, wetlands, and riparian areas;
2. Endangered species and species of special concern identified by natural resource agencies;
3. Cultural resources, both historic and archeological;
4. Water quality, river sediment contamination, groundwater, erosion, and sedimentation; and
5. Social and economic resources, including the loss of established neighborhoods.

NATURAL RESOURCES

Existing Setting

The communities of East Grand Forks, Minnesota, and Grand Forks, North Dakota, are located on the Red River of the North in the glacial lakebed of Lake Agassiz. The soil is glacial till and the climate is continental with moderate rainfall and temperature extremes. The area is part of the tall grass prairie ecosystem and is on the eastern edge of the prairie pothole (wetland) area.

The Red River of the North drains eastern North Dakota and western Minnesota. The Red Lake River is a major tributary to the Red River of the North that enters the river at East Grand Forks. The rivers have similar water quality and fisheries, which provide habitat for typical species including channel catfish, walleye and northern pike, among others.

The riparian corridor through the two cities is narrow and bounded by emergency levees. Vegetation is limited and not continuous and provides habitat for species typical of disturbed and urban environments.

Environmental Effects on Natural Resources

The proposed plan would result in removal of the existing emergency levees. They would be replaced with new levees that would provide protection against floods equal to the flood of 1997. The area between the new levees would double in size and would be cleared of structures and associated infrastructure. It would be allowed, for the most part, to revert to natural vegetation. This would increase its habitat value substantially because it would be less disturbed and less patchy, eventually forming a riparian corridor of native vegetation through the urban area. The vegetation would provide greater habitat diversity for more species. Understory plants would filter runoff and improve water quality in the rivers. Overhead vegetation would provide some shade and improved cover for fish.

There would be two diversions at English Coulee and Hartsville Coulee. These watercourses are intermittent runoff streams that collect overland flow. Since the diversion would function only during flood periods, the diversion would be expected to have minimal effect on the habitat downstream of the diversions. The plan would include the placement of riprap near the Riverside Dam and the confluence of the two rivers. This would reduce bank erosion and sedimentation in the river, stabilize conditions at and near the dam, and provide some solid substrate for the growth of fish food organisms. No excavation of the riverbed would take place. No contaminated material would be disturbed or exposed.

The project would have no effect on groundwater, and construction would not disturb wetlands. Rock would be obtained from farmers' field piles or quarries. The emergency levees would provide much of the material for the construction of new levees, thus limiting the need for excavating new borrow sites. Except for demolition debris, there would be only limited material for disposal.

In summary, the benefits of establishing a 2,000-acre riparian corridor or greenway through the urban area would be an increase in habitat and improvement in water quality that would more than offset the minimal adverse effects of construction and operation of the flood reduction project.

Cultural and Historic Resources

GENERAL

Section 106 of the National Historic Preservation Act (NHPA) of 1966 (Public Law 89-665), as amended, requires that a Federal agency take into account the effect of an undertaking on properties listed on or determined eligible to the National Register of Historic Places and afford the Advisory Council on Historic Preservation a reasonable opportunity to comment with regard to the undertaking. The implementing regulation for Section 106 is the Advisory Council's regulation for the Protection of Historic and Cultural Properties (36 CFR Part 800). Section 110 of the NHPA requires a Federal agency to preserve and protect historic properties in the area of a Federal undertaking to the extent feasible and, where not feasible, to ensure that the appropriate level of documentation is completed prior to alteration,

relocation, or demolition. The National Environmental Policy Act (NEPA) (Public Law 91-190) requires that the Federal agency prepare an environmental assessment or environmental impact statement as part of the planning and decision-making process. Historic and other cultural resources are to be considered as part of the EIS process.

The Cities of Grand Forks and East Grand Forks specified that their flood protection system had to be permanent, had to provide a 210-year level of protection (1997 flood plus 3 feet of freeboard), and had to be economically, environmentally, and socially acceptable. Geotechnical considerations and soil stability were the main factors determining how close to or far from the river the levees could be built. A goal of keeping levee heights at 10 feet or less was established for reliability reasons, to improve future floodfighting capability, was consistent with Washington level desires to see levees setback from the river channel where possible. It also served to lessen the visual impacts of the flood protection features. At a number of locations, a higher levee was necessary in order to save more residences.

Prior to February 1998, the Corps was looking at two flood protection alternatives for East Grand Forks and Grand Forks. The levees only alternative consisted of a system of levees that would provide protection for an event equivalent to the 1997 flood (210-year level of protection). The diversion alternative consisted of a combination of in-town levees providing a 100-year level of protection plus a diversion channel for the Red River to handle any additional flows up to the 1997 flood equivalent. The Plan Comparison Letter Report the Corps provided to help the Cities decide on which flood protection alternative to pursue contained cultural resources information for the levees only alternative and the levees portion of the diversion alternative provided by the Corps and cultural resources information for the Red River diversion channel portion of the diversion alternative provided by IMA Consulting, the archeological subcontractor for Short Elliott Hendrickson (ref. Florin et al., 1998, *Grand Forks/East Grand Forks General Reevaluation: Cultural Resources*, IMAC, Minneapolis). The proximity of the levee alignments for the two alternatives meant that the potential effects to cultural resources in town would have been the same for both alternatives. However, the diversion alternative would have had added impacts to cultural resources over the levees only alternative, particularly where the diversion channel exited and reentered the Red River. Primarily for economic reasons, the Cities elected to pursue the levees only alternative.

Once the general levee alignment was determined for each city, the Corps took a detailed look at geotechnical and soil stability factors for each segment of the alignment to determine if the proposed levee could be moved farther riverward in order to preserve additional buildings and city infrastructure which otherwise would have been lost. Some adjustments to the location of the proposed flood protection alignment were also made possible by substituting the more expensive mechanically stabilized earth walls and floodwalls for segments of levee.

Specific refinements to the alignments involving historic properties included substitution of a floodwall for the levee along North Third Street from Lewis Boulevard to just past Second Avenue North in order to save houses along that street and to preserve historic buildings in downtown Grand Forks, including the former Northern Pacific Railroad Depot and Freight House. In the case of St. Anne's Guest Home on Lewis Boulevard just south of Highway 2, a combination of shifting the levee alignment slightly landward and floodproofing the lower floors was selected so that this National Register listed building could be preserved in place.

In the Riverside Park area north of downtown Grand Forks, part of the levee alignment between Park and Seward Avenues could be shifted riverward to the east side of Lewis Boulevard. This means that additional historic houses in the Riverside Park Historic District and part of the National Register listed granitoid pavement of Lewis Boulevard will now be protected. Levee size and geotechnical and soil stability do not allow for relocation of the proposed levee alignment farther riverward in this area.

In the Reeves Drive area south of downtown Grand Forks, a number of options are being looked at to minimize impacts to this historic neighborhood, which is part of the East Side Residential Historic District. The most viable option consists of substituting a floodwall for the levee and moving those houses that still cannot be avoided to the front of their lots. Channel modification, involving shifting the Red River channel eastward and building up the area riverward of these houses so that they can remain in place with a levee or floodwall built on the filled area, was also looked at as an option, but it is infeasible for legal and environmental reasons. Additional information on the Reeves Drive area is included in the Areas of Controversy section of the EIS.

Another area of controversy is the Corps proposal to remove the National Register eligible former Northern Pacific Railroad Bridge that spans the Red River just north of Demers Avenue. This center-pivot railroad swing bridge was converted to a stationary pedestrian bridge when the City of Grand Forks acquired it in 1983. The Corps is proposing to remove the bridge and its large central stone pier and two wooden side piers in order to reduce the obstructions to flow in the river. Removal of the bridge means that the water in the Red River upstream of its location would be up to 6 inches lower than with the bridge present. This, in turn, means that the proposed levees and floodwalls upstream would not have to be built as high as if the bridge remains. The North Dakota State Historic Preservation Office and the Grand Forks Historic Preservation Commission prefer that this historic bridge remain in place. Additional information on the proposed bridge removal is included in the Areas of Controversy section of the EIS.

PROGRAMMATIC AGREEMENT

Because of the multi-State nature of the proposed flood protection project and because the effects on historic properties in the project area cannot be fully determined prior to its authorization, the St. Paul District, U.S. Army Corps of Engineers negotiated a Programmatic Agreement (PA) with the North Dakota State Historic Preservation Officer (NDSHPO), the Minnesota State Historic Preservation Officer (MNSHPO), and the Washington office of the Advisory Council on Historic Preservation (Advisory Council). The Cities of East Grand Forks and Grand Forks, as Local Sponsors, are concurring parties to this agreement. The Grand Forks Historic Preservation Commission is also a concurring party. The Programmatic Agreement, a copy of which is included with the EIS, stipulates what the Corps will have to do in order to be in compliance with Sections 106 and 110 of the NHPA and with NEPA.

Stipulations of the PA cover (1) the identification of archeological, historical, and architectural sites in the project area; (2) the National Register eligibility evaluation of these sites, buildings, and structures; (3) the procedures to be followed if human burials are found in the project area; (4) the identification of traditional cultural properties in the

project area; (5) the identification of new historic districts, multiple resource areas, historic landscapes and viewsheds in the project area; (6) guidelines to be followed in the treatment of historic properties in the project's area of potential effect; (7) mitigation of adverse effects, both individual and cumulative, to historic properties; and (8) provisions for public and tribal involvement in the Section 106 process.

INVENTORY AND EVALUATION OF HISTORIC PROPERTIES

A St. Paul District Corps archeologist conducted a literature and records search at the State Historic Preservation Office of the Minnesota Historical Society in St. Paul in October 1997, and at the Archaeology and Historic Preservation Division of the State Historical Society of North Dakota in Bismarck in December 1997. The literature and records search was conducted to determine the extent of previous archeological surveys and architectural inventories in the vicinity of Grand Forks and East Grand Forks and to compile a list of prehistoric archeological, historic archeological, and architectural sites and site leads for the potential project area locations in Grand Forks County, North Dakota, and Polk County, Minnesota. In addition, the Cities of Grand Forks and East Grand Forks provided the Corps with information on the year of construction of the various buildings and structures in the project area and information on which properties were acquired under their respective 1997 flood voluntary acquisition programs.

A summary of the prehistory and history of the Grand Forks and East Grand Forks portion of the Red River Valley, a summary of previous cultural resources investigations for the project vicinity, and an overview of the sites, historic districts and multiple resource areas in the project area are included in the Affected Environment section of the EIS. The Environmental Effects section of the EIS discusses the project's effects on National Register listed and eligible properties and on the two historic districts and downtown multiple resource area in the City of Grand Forks, as well as cumulative effects on the historic resources of both Grand Forks and East Grand Forks.

Detailed inventory information for the buildings, standing structures, and archeological sites located in and riverward of the proposed levee and floodwall alignments for East Grand Forks and Grand Forks is presented in Appendix E of this report. Tables E-1 of Appendix E (Grand Forks buildings and structures) and E-2 (East Grand Forks buildings and structures) list all the buildings and structures in these two cities within and riverward of the proposed levee or floodwall alignments. Specific information provided includes the type of building or structure, its official site number, the year it was built, its National Register eligibility status, whether it is located under or riverward of the proposed levee or floodwall alignment, and whether it was acquired under the respective city's buyout program. Appendix E, Table E-3, provides information on the known archeological sites and unverified site leads for the proposed project area including site number, type of site, section-township-range, National Register eligibility status, and location under or riverward of the proposed levee and floodwall alignments. Appendix E, Table E-4, provides a summary list of properties for each city which, as of July 1, 1998, are listed on or have been determined eligible for inclusion on the National Register of Historic Places.

In Grand Forks, a total of 36 National Register listed and eligible properties will be directly affected by construction of the proposed levees and floodwalls, not counting properties acquired by the city's separate 1997 flood voluntary acquisition program (see Table 9). These 36 properties include six listed on the National Register (St. Anne's Guest Home,

Boom Town Store #1, Red River Valley Brick Co., Viet’s Hotel Annex, Thomas D. Campbell House, and Granitoid Pavement at Lewis Boulevard and at South Fourth Street, Elm Avenue, and Fourth Avenue South) as well as nine residences north of downtown, 19 residences south of downtown, the Sorlie Memorial Bridge, and the former Northern Pacific Railroad Bridge, all of which have been determined eligible to the National Register. As of July 1, 1998, except for the above two bridges, no National Register listed or eligible properties will be directly affected in East Grand Forks.

Table 9 - Summary of Historic Properties in and Riverward of the Proposed Levee and Floodwall Alignments

	GRAND FORKS	GF/EGF (bridges)	EAST GRAND FORKS	TOTALS
BUILDINGS AND STRUCTURES				
LISTED ON NATIONAL REGISTER	6	0	0	6
DETERMINED ELIGIBLE	28	2	0	30
UNDETERMINED ELIGIBILITY	41	2	15	58
DETERMINED NOT ELIGIBLE	151	1	213	365
TOTALS	226	5	228	459
ARCHEOLOGICAL SITES				
LISTED ON NATIONAL REGISTER	0	N/A	0	0
DETERMINED ELIGIBLE	0	N/A	0	0
UNDETERMINED ELIGIBILITY	8	N/A	1	9
DETERMINED NOT ELIGIBLE	1	N/A	3	4
TOTALS	9	N/A	4	13
UNVERIFIED ARCHEOLOGICAL SITE LEADS (undetermined eligibility)	5	N/A	1	6

TABLE 9 - NOTES:

- Inventory of Project area and evaluations of National Register eligibility of archeological sites, buildings and structures are incomplete. Number of National Register eligible properties may increase as inventories and evaluations are completed. N/A = not applicable.
- Data as of July 1, 1998.
- Does not include properties acquired under the Cities’ 1997 flood voluntary acquisition programs.

Archeological sites of undetermined National Register eligibility which are known to be within or immediately adjacent to the proposed levee and floodwall alignment in North Dakota consist of a prehistoric cultural material scatter site near the English Coulee

crossing and a reported, but unverified, lead to an Indian cemetery riverward of 307 North Third Street. That cemetery was relocated to an unspecified location sometime prior to 1965. In East Grand Forks, the proposed levee alignment east of the Murray Bridge and north of the Red Lake River crosses the Grand Forks Lumber Company Sawmill site and an early twentieth century landfill. Additional archeological sites that may be affected by greenway developments riverward of the proposed levee and floodwall alignments are listed in Table E-4. Not all proposed greenway developments will be project related.

As of July 1, 1998, 41 buildings and structures in Grand Forks and 15 buildings and structures in East Grand Forks still need to have their National Register eligibility evaluated. Archeological surveys of the proposed levee and floodwall alignments, associated work areas and borrow areas, and the proposed greenway/floodway area riverward of the levees and floodwalls are scheduled for 1999. Formal testing and archival research to determine the National Register eligibility of any archeological sites that will be directly affected by levee or floodwall construction or by project-related developments within the proposed greenway area are also scheduled for 1999.

MITIGATION OF IMPACTS TO HISTORIC PROPERTIES

Those National Register listed or eligible properties that cannot be avoided by project construction will need to have the impacts mitigated through excavation, archival research, and/or formal Historic American Building Survey/Historic American Engineering Record (HABS/HAER) recordation. Construction of the levees and floodwalls will affect the overall historical integrity of the Grand Forks Downtown Multiple Resource Area, the East Side Residential Historic District (centered on the Reeves Drive area), and the Riverside Park Historic District (centered on the Lewis Boulevard/Riverside Drive area) to varying degrees. Adverse effects to the viewshed and overall setting of historic buildings located landward of the levees and floodwalls will be addressed through landscaping, wall treatments, or some other type of physical screening to the extent feasible. Use of vegetation for visual buffers may not be possible along many levee reaches for geotechnical stability reasons because of the proximity of the proposed levee and floodwall alignments to the Red and Red Lake Rivers. Because of the number of historic properties to be directly and indirectly affected by project construction, some form of cumulative effects mitigation, probably involving the development of an interpretive exhibit or program for the general public on the historic aspects of East Grand Forks and Grand Forks, will also be implemented. However, some reaches of the project alignments may ultimately be able to be aligned further riverward to reduce the number of structures that would be significantly impacted. These possible adjustments are ongoing and will be fully explored with the non-Federal Sponsors during the construction phase of the project.

Flood protection project construction could start on a small scale in 1999 if the Water Resources Development Act of 1998 authorizes construction funding for the project. This would involve removal of the existing railroad swing bridge that currently serves as a pedestrian bridge. Major construction on the levees and floodwalls would likely begin in the year 2000 and be completed in 2004. Mitigation of adverse effects to historic properties would be conducted during the 1999 to 2001 field seasons and would be completed for a particular flood protection reach prior to starting construction at that location.

Real Estate

The cost analysis for the Grand Forks, North Dakota, and East Grand Forks, Minnesota, Flood Reduction Project is separated into three parts -- Grand Forks; East Grand Forks south of the Red Lake River; and East Grand Forks north of the Red Lake River (Reference plan sheet plates 3, 4, 5, 74 and 127). Valuation analysis was determined by the Direct Sales Comparison Approach. Each type of land was analyzed individually from current sales in the area. Residential sales were analyzed by individual neighborhood. The tieback levees and the diversion channels were valued at the agricultural land rate established from current County sales.

Each plate provided by General Engineering Section was analyzed individually. Permanent easement was valued at the full fee simple rate. Temporary easement was valued at the rental rate or current lending rate. The established rate was concluded at 10 percent of the fee rate. Residential improved properties were valued by a sales analysis representative of each neighborhood. Commercial activities and ongoing businesses to be taken were analyzed by the depreciated reproduction cost new of the improvement and included relocation and reestablishment for each. This assumes each will be relocated and business will be continuing.

Finally, an accumulation of each plate in a summary analysis for each of the three areas for Lands and Damages and Relocation assistance was provided. An administrative analysis of the costs for administrative oversight by the Corps of Engineers and the administrative costs for the cities to go forth and acquire the parcels necessary to build the project were estimated. Table 10 presents the breakout of acres of real estate acquisition of unimproved lands, and the structures that are to be relocated for Grand Forks, East Grand Forks (north end), and East Grand Forks (south/Point end).

Table 10 – Acquisition Requirements

Area of Community	Acres of unimproved lands required	Homes to be acquired	Businesses and public buildings to be acquired
Grand Forks	405 acres fee title 264 acres temporary easements	206 single-family homes 24 apartments 11 condominiums	6 businesses RDO wastewater treatment plant ; Portion of City water treatment plant
East Grand Forks (north end areas)	177 acres fee title 49 acres temporary easements	16 single-family homes 60 apartments No condominiums	10 businesses
East Grand Forks (south/Point areas)	153 acres fee title 37 acres temporary easements	30 single-family homes No apartments No condominiums	No businesses

Contingencies were applied at the rate of 20 percent because of the unknown elements. Final conclusion was provided to Cost Estimating Section. For more technical detailed information, see Appendix F of the Supplemental Documentation report.

Structural Design

Structural engineering for this report consisted of stability analysis and sizing of significant members for the structural features identified on the project. Structural features associated with this project include floodwalls, railroad and roadway closures, drop structures, interior flood control structures, and miscellaneous drainage structures.

The primary objective of this effort was to determine the feasibility of designs and to establish reasonable quantities for the baseline cost estimate. The level of design was conducted to sufficient detail to attain these objectives. The design of structural features followed governing Corps criteria as follows: EM 1110-2-2502, Retaining and Floodwalls (Floodwalls, Closures, and Headwalls), EM 1110-2-2705, Structural Design of Closure Structures for Local Flood Protection Projects (Closures), EM 1110-2-2104, Strength Design for Reinforced Concrete Hydraulic Structures (all reinforced concrete), ETL 1110-2-307, Flotation Stability Criteria for Concrete Hydraulic Structures (pump stations and gate wells), and EM 1110-2-2902, Conduits, Culverts and Pipes (all drainage culverts).

Floodwalls and closures are reinforced concrete cantilever T-type. All closures are the stoplog type. There are over 2.7 miles of floodwalls ranging in height from about 8 to 18 feet. There are 16 separate roadway and 3 railroad closures ranging in height from about 5 to 17 feet. Load case I2, as described in EM 1110-2-2502, was assumed to be the controlling load case for floodwall and closure designs. Base slabs are embedded 6.5 feet for frost protection and are founded on a 6-inch-deep working platform of granular bedding. Concrete keys were used to aid in sliding resistance. A soil crack was assumed to exist to the bottom of the key and the seepage path taken from the key to the top of soil on the protected side. Closure stoplogs were designed assuming supports at 5-foot intervals using propped wide-flange beams.

Drop structures are reinforced concrete supported on steel H-piles. A cutoff key is attached to the downstream end of the slab to aid in erosion control. Two loading conditions were investigated, water to the top of the structure walls, and no water loads. Walls were designed as cantilevered members subject to soil and water loads and the slab was designed as a simply supported member subject to bearing pressures. Sliding and bearing stability were evaluated following criteria from EM 1110-2-2502. Drop structure retaining walls were sized on the basis of wall configurations of a similar project.

Interior flood control structures include pump stations, gate wells, headwalls, and drainage conduits. Two larger, type 3, pump stations are needed to provide interior drainage capacity at English Coulee and at Belmont Coulee. Generally, all pump stations, gate wells, and headwalls are reinforced concrete supported by shallow foundations except for the large pump station at Belmont Coulee which is founded on steel H-piles. The large pump station includes a superstructure constructed of masonry

block walls and a steel truss and metal panel roof. All combined pump stations and gate wells, except for the large pump station at Belmont Coulee and the inlet and outlet structures at Hartsville Coulee, were sized on the basis of structures of similar size and configuration at other projects. The large pump station and inlet and outlet structures were analyzed for bearing and flotation stability. Structural members were designed assuming flat plate behavior, where applicable; otherwise, beam behavior was assumed. Building design was based on design of a similar project.

Miscellaneous drainage structures consist of pump station and gravity outlet and inlet conduits, sewer interceptor conduits, and roadway drainage ditch conduits through levees. The latter conduits are attached to headwalls with flap gates. All conduits are precast, reinforced concrete pipes. General design assumptions for these items are that inverts are 10 feet below ground elevation and class 5 reinforced concrete pipes satisfy strength requirements. Actual pipe designs were conducted where load conditions were known. Headwall designs are based on past experience.

See Appendix I for a complete description of structural design.

Mechanical and Electrical

The pump station and gravity flow gate well outlet designs for the mechanical and electrical systems will be coordinated with interior drainage requirements. Pump station designs will be segregated into three design categories. The final design categories will be selected on the basis of system capacity requirements developed from the interior drainage study of the hydraulic design. The three preliminary design categories adopted include small stations (0-2500 gpm), medium stations (2500-8000 gpm), and large stations (over 8000 gpm). Pump station design will be standardized within each category. Alternate studies for type of pump and prime mover will be developed in the interior drainage design memorandum. The stations will be suitable for location in an urban area with either floodwall or over-the-levee discharge lines.

The following publications will be used to establish the capacity and layout of pump stations:

TM 1110-2-3105 - Mechanical and Electrical Design of Pumping Stations

TM 1110-2-3103 - Architectural Design of Pumping Stations

Hydraulic Institute - Standards for Centrifugal, Rotary, and Reciprocating Pumps (14th Edition) 1997.

The mechanical design will include development of the general plant layout for each station category. This will include the pumping equipment, discharge pipe selection and layout, water control gates, trash racking, equipment handling cranes, and heating/ventilation. The analysis will also review pumping station equipment maintenance and repair criteria. The design will be closely coordinated with the engineers preparing the structural design.

The electrical design will include the establishment of electric service, and pump station power, control and lighting systems. Pumping stations protecting high value areas will include

an emergency standby generator. All pumping stations will have provisions for connection of an emergency standby generator. A small Supervisory Control and Data acquisition (SCADA) system will be installed at each pumping station. The SCADA system will simplify management of the large number of small pumping stations included in this project.

Cost data for the construction of mechanical and electrical features will be included in the cost engineering study prepared for this report. Design refinement will be necessary to develop pumping station concepts that provide for the most cost-effective product.

Greenway Plans

GREENWAY CONCEPT

The initial Conceptual Greenway Plan was prepared by a team of Landscape Architects and a Cost Engineer from the St. Paul District, Army Corps of Engineers in response to a North Dakota Congressional request. The objective was to integrate a Greenway concept for the area between the rivers and the permanent flood protection boundaries that would be acceptable to the communities of East Grand Forks and Grand Forks. The Conceptual Greenway Plan prepared in May 1997 defines a strategy for controlling future flooding and providing recreation. The Greenway envisioned in the concept plan would encompass over 2,000 acres of land between the two cities.

To refine the first Conceptual Greenway Plan and to gain involvement and support from local officials, sponsors, community groups, the public, adjacent landowners, businesses, and State and Federal agencies, the Corps of Engineers hired a Greenway consultant to facilitate two Greenway Workshops. They were held on February 5 and 6 and on March 11 and 12, 1998. The objective of these workshops was to bring together a multidisciplinary group of people to: 1) Unify the communities in a common purpose; 2) Set a vision, goals and objectives; 3) Identify an action plan required to implement the vision; and 4) Create partnerships for the design, funding and maintenance of the Greenway. The contractor, Greenways Incorporated, from discussions that took place at the workshops, prepared the Red River of the North Greenway Report (see Appendix G of the Supplementary Documentation report for additional information).

On the basis of inputs received from the workshops, the Corps revised the Conceptual Greenway Plan in June 1998. The next step is to prepare a coordinated master plan for the Greenway. This needs to be accomplished at the local level with limited Corps involvement. Figure 3 shows the revised Conceptual Greenway Plan.

It is important to understand that the proposed recreation development to be done as part of the Federal flood reduction plan will not complete development of the Greenway. The extent of the Greenway development accomplished as a result of the flood reduction project will be limited to the development of a perimeter trail system with a number of trail entry points, parking, restrooms, trailhead information facilities, and limited day-use facilities for picnicking. The trail facilities will provide a circulation framework, and the parking and restrooms will provide critical support facilities upon which additional locally designed and implemented Greenway development can be built. In order to realize the full potential of a greenway, a

locally led Greenway Master Plan has been discussed, and the City of Grand Forks has identified/assigned a local Greenway coordinator. A joint powers agreement has been initiated to establish a local political entity with the responsibility to plan, implement, and operate the Greenway.

BENEFITS OF A GREENWAY

Opportunities abound with the addition of a Greenway. These include widening the floodway, revitalizing the economy, restoring ecological river systems, providing recreation, improving health and physical fitness, and unifying the communities. The Greenway may serve to hold the communities together by providing a common bond, a sense of belonging, and spiritual or emotional value when the residents become involved in the Greenway planning and development process. Sharing and getting involved in planning the Greenway can provide an opportunity for people to work on projects, meet others, learn, talk about their experiences, and go through the healing process. Residents can pursue their area of interest in cultural/historical resources, recreation/open space, landscaping and gardens, environmental education, enhancing biological diversity, improving water quality, creating a memorial space, or other endeavors.

In addition to providing areas of undisturbed and restored floodplain, the Greenway can offer a place to recreate, socialize, walk and bike. The Greenway would improve the visual aesthetic quality of the area by enhancing views, adding buffer zones, and shaping land to fit into the surrounding landscape. The land surrounding the Greenway may also reflect higher real estate values.

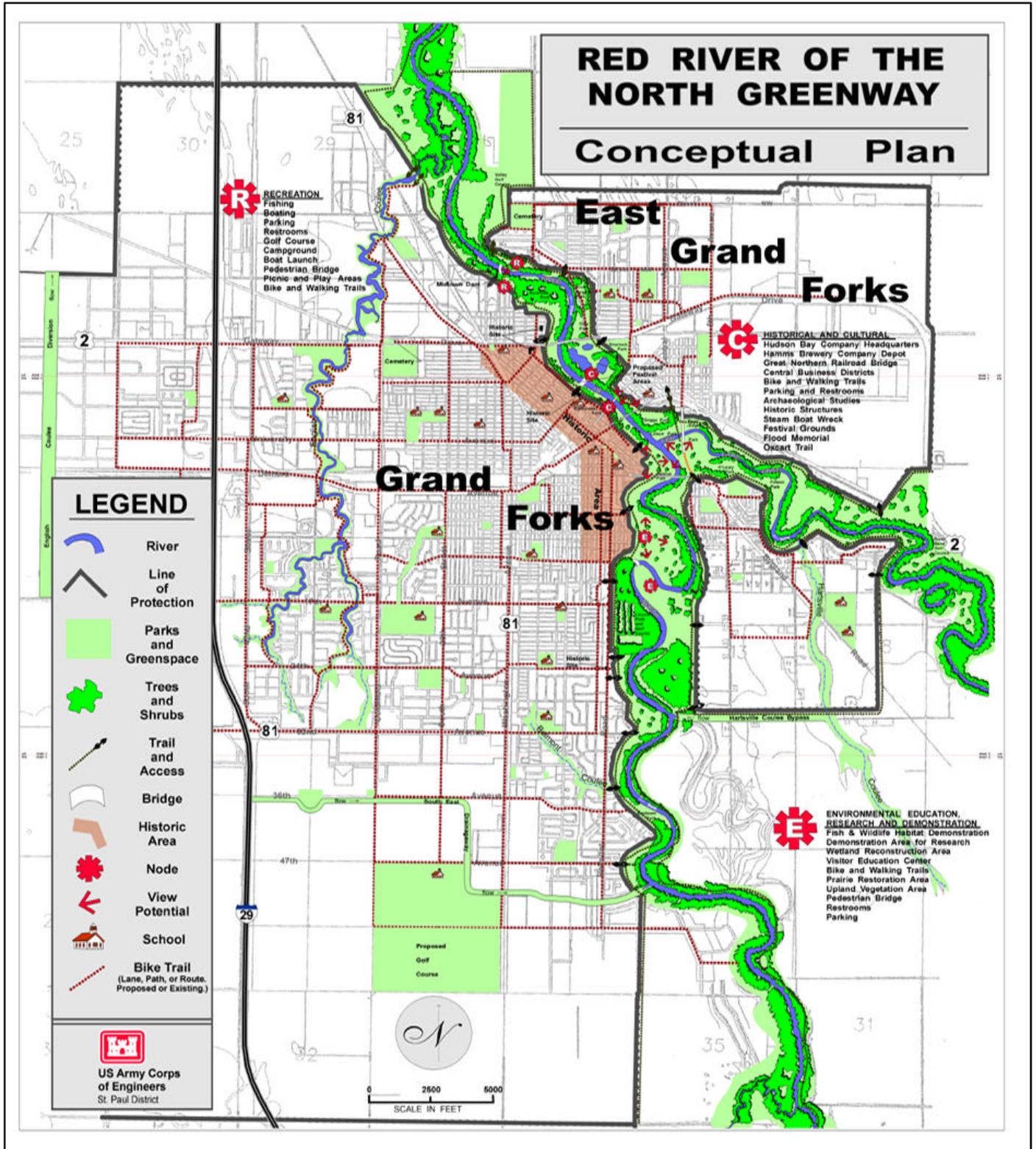


Figure 3 – Greenway Concept Plan

CORPS AESTHETICS AND RECREATION FEATURES

The recommended plan is a multipurpose project that includes recreation and aesthetic features. The recreation and aesthetic features have been integrated into the design and cost estimates for the recommended plan presented in this report. A more detailed discussion and description of these features follows.

Aesthetics - Visual Quality Assessment

Aesthetic designs and features are considered to be an integral part of the overall project design. Accordingly, landscape plantings and earthen warp sections have been integrated into the design of the recommended plan. These are included in the cost estimate for implementation of the recommended plan, and they will be evaluated further during the detail design efforts. These aesthetic features are cost shared as a basic cost of the flood reduction features. The extent of aesthetic features to be implemented as part of the project depends upon the Local Sponsors' priority for seeing such features integrated into the project. There are limits upon the type and cost of aesthetic features that are allowable can be and cost shared as a basic part of the project. However, betterments are possible, at the non-Federal Sponsor's option, for any additional aesthetic treatments that are beyond the type of features or funding limits allowed.

The design of aesthetic features must also be consistent with the primary flood reduction design criteria and Corps-wide design standards. Because of the study area's soil stability problems and the strong desire to minimize the number of structures affected by construction of a permanent flood reduction project, the project alignment has been moved riverward to the maximum extent practical. As a result, the space to implement aesthetic features is not available or is very small in many areas. This adversely affects the Corps' ability to integrate aesthetic features in those areas. This is particularly a problem in some residential reaches of the recommended project. In spite of these constraints, aesthetic inventories and integration of designs for aesthetic features have been accomplished wherever possible as part of the proposed project.

INVENTORY OF VISUAL RESOURCES

Visual resources are an important part of any Corps of Engineers project. The U.S. Army Corps of Engineers Visual Resource Assessment Procedure (VRAP) was used to evaluate the visual resources of East Grand Forks and Grand Forks that will be affected by the Corps flood reduction project. The VRAP process includes identifying the regional landscape, compiling an inventory of existing visual resources, assessing visual impacts, obtaining public input, evaluating alternative plans and solutions, and forecasting with and without project conditions using visual simulations to show design alternatives.

Visual quality is based on several factors, formed from many components. The visual quality of a landscape is based on factors such as variety, interest, and views. These factors are comprised of color, texture, form, and line (each with its own components)

and influenced by elements such as space, light, the observer's senses (smell, feel, hear), and impacts (such as scarcity and disturbance). All of these play over the landscape which, in turn, is made up of its own set of components: land, water, vegetation, structure, etc. Aesthetics can be defined as being concerned with the characteristics of objects or collections of objects (in this case, the landscape) and the specific human perceptions that make them pleasing, or displeasing, to our senses. It should be observed that there are many definitions of "aesthetics," and no agreement as to the use of the word. Aesthetic attributes refer to perceptual stimuli that provide diverse and pleasant surroundings for human enjoyment and appreciation. Sights, sounds, scents, tastes, and tactile impressions interact with natural resources and cultural influences to produce psychological feelings of pleasure in certain landscapes. But all humans are different; thus, aesthetic attributes are subjective. The old adage "Beauty is in the eye of the beholder" still holds true.

Historically, this is the northeastern edge of the Great Plains of North America – a vast expanse of rolling, grass-covered hills inhabited by semi-nomadic Native American tribes. Today, the region is part of the Midwestern farmbelt, the "Bread Basket of America." It is a sparsely populated area – a rural landscape that stretches across the center of the continent for hundreds of miles. About 50 to 70 miles to the east of the project is the vegetative transition zone where the naturally occurring, rolling grassland changes to northern coniferous forest, dotted with thousands of lakes and streams.

This region comprises the eastern edge of the Northern Great Plains, and the native biota is both wet and dry prairie dwelling species. Historically, vegetation consisted of grasses, sedges and wildflowers on the vast level areas, and occasional patches of northern floodplain forest along the streambanks and in the gullies. As tremendous fires periodically swept the prairies, the only woody plants in the area were those that survived them. As a natural consequence, stands of native trees and brush were few and widely scattered, found only on the streambanks or in naturally protected areas. Today, the region is part of a vast, rich agricultural network stretching from the Rocky Mountains to the lakes region of Minnesota.

Professional evaluators have completed the visual similarity zone map (see Figure 4) and the VRAP inventory for East Grand Forks and Grand Forks. More detailed evaluations of project visual quality will be prepared and coordinated during the next phase of the flood reduction project using the visual similarity zone map and the visual assessment inventories for Grand Forks and East Grand Forks. This will be accomplished after the General Reevaluation Report is completed as part of the detailed design that will follow. This evaluation will include the following:

- Identify significant visual resource impacts to be avoided (soil stability/erosion, etc.).
- Predict adverse changes in the visual resources, such as site specific components (e.g., riparian vegetation) that should be protected to preserve existing visual and environmental quality.
- Examine the landscape composition to identify spatial dominance, scale, contrast, and compatibility of landscape elements and characteristics.

- Combine public and professional input to determine what visual changes are acceptable.
- Make recommendations on how to proceed into the design phase that address items such as floodwall treatments, blending levees into surrounding topography, limiting access to areas of high visual quality, and providing visual screening (using trees and shrubs to improve the visual qualities of the project).

Public Input

Visual resource information and concerns from the public will be gathered at future public workshops and neighborhood meetings to be accomplished during the detailed design phases after this General Reevaluation Report.

Evaluation of Alternative Alignments

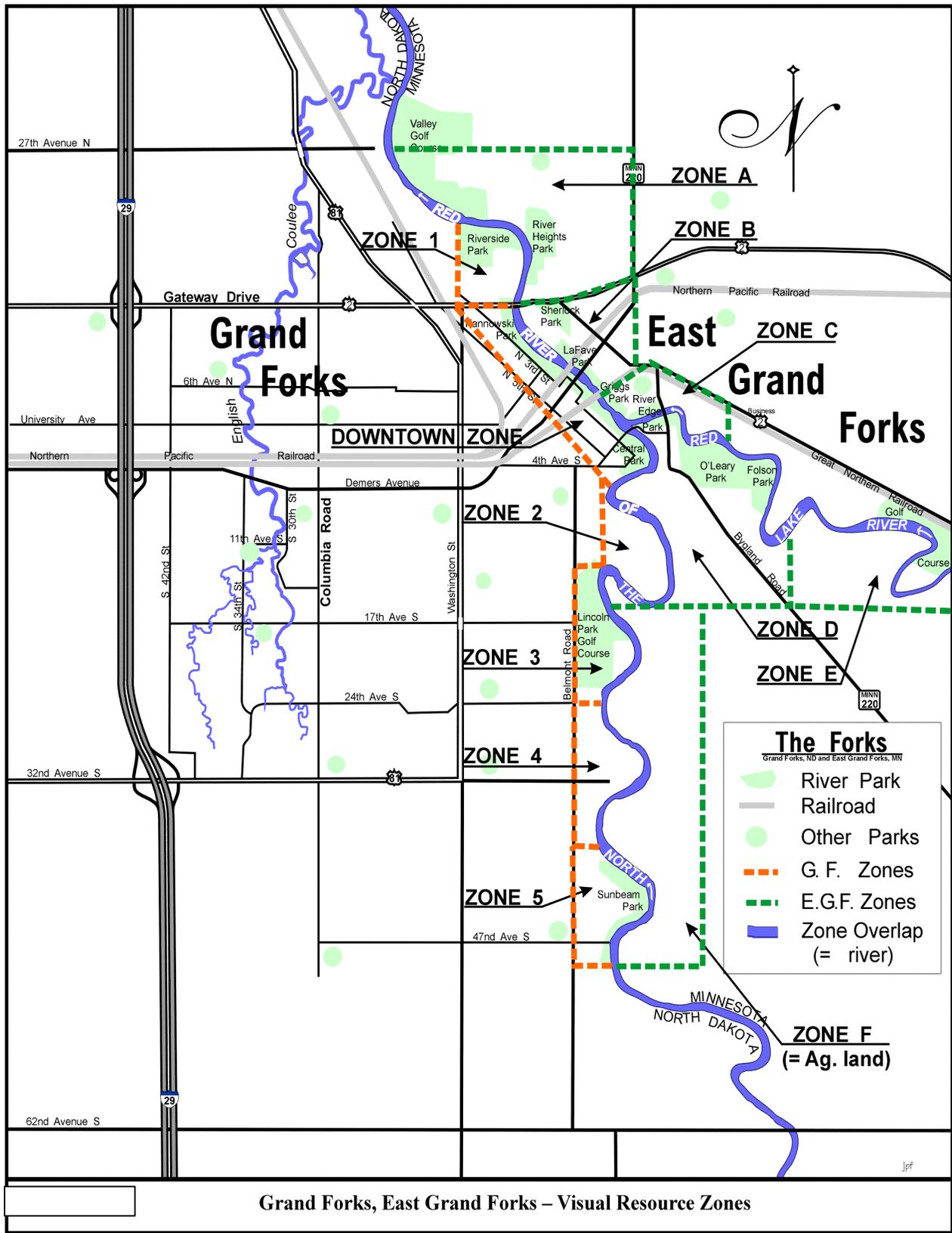
Early computer generated visual simulations of project alternatives have been invalidated by changes in the levee and floodwall (flood reduction structures) alignment. Additional simulations of project alternatives will be prepared during the next phase of the flood reduction project. Areas of concern will be noted as part of the VRAP process.

Aesthetic Issues of Concern

The height of some of the floodwalls and levees has created physical barriers and overwhelming visual dominance issues. This could have a negative impact on the project's visual qualities and undermine public enthusiasm, support, and participation in the project. Specific causes for concern include the following:

- Cultural/historic areas where levees or floodwalls will be built.
- Extremely high floodwalls or levees in some neighborhoods.
- Views of typical levee construction (1:3 slopes).
- Views of specific levee or floodwall treatments.
- Walls that block existing pedestrian/bike connections.
- Walls or levees that block prominent views of open, urban green space.
- Walls or levees that block views to the river.
- Fitting walls/levees into the surrounding landscape (especially neighborhoods).
- Lack of real estate for levee overbuild and landscape plantings (naturalization).
- Lack of pedestrian spaces near the levee – auto dominant planning and design.
- Lack of space for the “Fingers of Green” concept of the Greenway plan.

Figure 4



Measures to Lessen Visual Impacts

- Levees may be graded and shaped into undulating natural shapes and planted with trees and shrubs (naturalized) to fit into adjacent neighborhoods. Because of limited space between the levee/floodwall and adjacent residences, businesses, and other buildings, many areas may not have enough space this type of aesthetic treatment.
- Landscaping may be provided to minimize impacts and blend walls and levees into the surrounding landscape. Vegetation can be used to minimize the visual and physical dominance of high flood reduction structures by visual screening, providing or distorting scale, presenting diversity, and piquing interest.
- Wall treatments will be needed to lessen visual impacts in historic as well as non-historic neighborhoods.
- Significant viewsheds will be addressed.
- Areas for wall enhancements and special features in the commercial downtown areas will be identified.

RECREATION FACILITY NEEDS

This section of the report quantifies and evaluates recreation resources available to the residents of Grand Forks, North Dakota, and East Grand Forks, Minnesota, and assesses the recreation potential of the area. It examines the recreation resources of the cities and of the area readily accessible to the recreation users of the two cities; i.e., the area of regional influence. This area is considered to be recreation resources that can be reached within 1 hour, or within a 50-mile radius, of the population center. A 50-mile radius is shown on Figure 5 below.

Local Recreation

Grand Forks - Before the devastating flood of 1997, the City of Grand Forks had a population of about 52,500. Because Grand Forks is a metropolitan growth center, it has experienced a consistent rate of natural increase over the last decade. Population growth has been due to natural increase and the expansion of employment opportunities. Expectations before the 1997 flood predicted that the economy would expand as a metropolitan service and trade center, in major retail facilities, and in improved and expanded medical facilities. A recent news article estimated a drop of approximately 2,000 residents since the flood, bringing the population count down to around 50,000 people in 1998. If moderate growth continues at a 0.9-percent annual growth pattern, the population is expected to reach 58,000 to 60,000 by the year 2020. Existing park facilities are shown on Figure 6.



Figure 5 - Regional Influence

Approximately 550 acres of parks, open space and public recreation land are within the city limits, with an additional 400 acres of parks, open space, and recreational facilities outside the city limits. Outdoor recreation areas include roughly 20 public parks and 2 golf courses (an additional golf course exists just south of the city limits). Five parks, listed below, are within the flood reduction project boundaries.

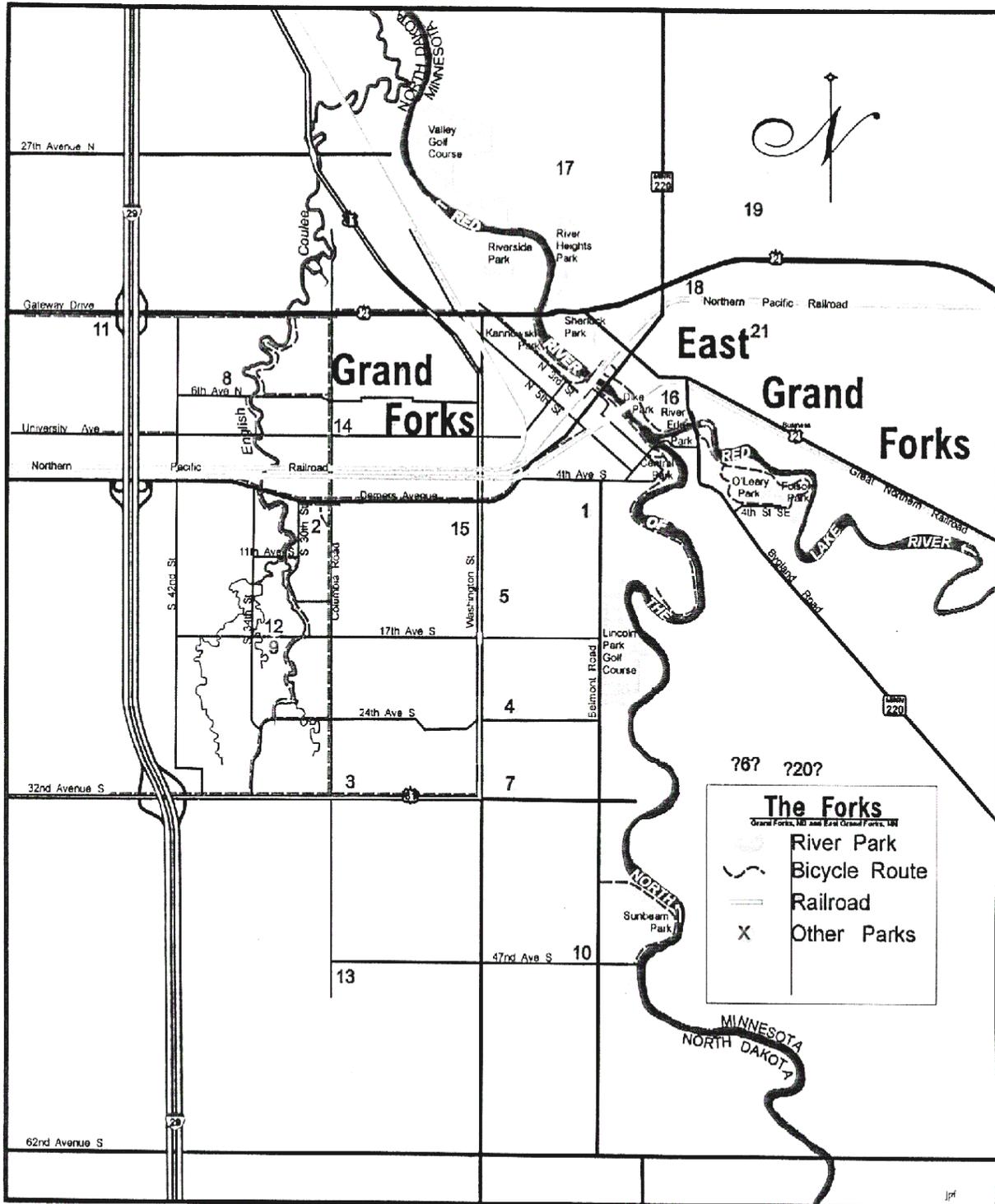
- Sunbeam Park is at the south (upstream) end of the city. This strip park follows the meandering Red River and features a paved multipurpose trail along its entire length and old growth forest at the south end.
- Lincoln Park is a more traditional park with a picnic area and shelter, horseshoe pits, play equipment, tennis courts, flower gardens, and restrooms. Lincoln Park also features a public 18-hole golf course with a clubhouse and parking for 150 cars. Cross-country skiing is offered in the winter. This park serves as a valuable visual corridor along Belmont Road. The golf course is an attractive, open green space

within an urban setting, offering panoramic views to surrounding residents. North Lincoln Park has a warming house, playground, and flower gardens adjacent to the golf course.

- Central Park is a traditional park providing picnic facilities and a shelter, horseshoe pits, play equipment, flower gardens, a bike trail and restrooms. It has skating and hockey rinks for winter use and provides an auto tour.
- Kannowski Park is a small park between the downtown area and the Red River. It is adjacent to the downtown business district and has flower gardens, benches and shelters, a gazebo, a water fountain, bike racks, a bike trail and a sidewalk system that connects Central Park to the south and Riverside Park to the north. The historic Great Northern Railroad Bridge serves as a major pedestrian corridor linking Grand Forks to East Grand Forks. The renovated railroad station serves as a tourist information center.
- The City of Grand Forks owns the Riverbank strip of land between the Kennedy Bridge and the Point Bridge (Minnesota Avenue). This strip provides about 50 acres of valuable open green space for the City's trail system.
- Riverside Park is at the north (downstream) end of the project. A traditional park, it provides picnic facilities and shelters, 4 tennis courts, baseball fields, open field, play equipment, horseshoe pits, flower garden, skating and hockey rinks, warming house, a swimming pool and bathhouse. Riverside Park is an attractive open green space within an urban setting, offering panoramic views to surrounding residents. Park trails link it to Kannowski Park and the downtown business district via low traffic, historic Lewis Boulevard.

Grand Forks Park District Survey -This survey was conducted to gain information to support Park District decisions for future community recreation facility needs. Although the full report is not yet available, preliminary results of the survey show that respondents overwhelmingly selected Trails in the Greenway (45.4 percent) as the top priority for new recreation facilities and More Parks and Picnic Areas (33.5 percent) as the second priority. Outdoor Winter Sports Area had a 26 percent preference and Playground Improvements had a 25.3 percent preference. The participation frequency rate was 51.8 percent for Individual Fitness and Sports and 32.4 percent for Outdoor and Nature. Other recreation facilities preferred by local area residents included (in order of importance) an indoor swimming pool, a community recreation center, a new golf course, a campground, community gardens, and several other recreational facilities.

East Grand Forks - East Grand Forks has a considerably smaller population base and is bisected by the Red Lake River. The current population figure, about 7,050, is a decrease of approximately 1,000 to 1,600 people since the 1997 flood. If population trends continue with an 0.8-percent annual growth pattern, as before the flood, the population projection through the year 2020 is between 8,000 and 9,000 people.



- | | | | |
|----------------------|-------------------------|---------------------|-------------------------|
| Other Parks: | 6. Haake Strip Park | 12. Sertoma Park | 18. Hecht |
| 1. Abbott Park | 7. Kelly Park | 13. Ulland Park | 19. ITT's Williams Park |
| 2. Ben Franklin Park | 8. Lake Agassiz Park | 14. University Park | 20. Nash Park |
| 3. Bringewatt Park | 9. Lions Park | 15. Wilmar Park | 21. Strauss Park |
| 4. Cox Park | 10. Optimist Park | 16. Griggs Park | |
| 5. Elks Park | 11. Richard's West Park | 17. Harney Park | |

Figure 6 - Existing Park Facilities

The City of East Grand Forks has established several parks along the south side of the Red Lake River and along the east bank of the Red River. About 14 parks have over 200 acres combined total. Seven of these parks are within the flood reduction project boundaries. Existing park facilities are shown on Figure 6.

Parks located on the Red Lake River:

- Folsom Park – Large open area for passive trail use – has a boat launch.
- O’Leary Park –Year-round facilities – trail.
- Griggs Park – Small playground and skating area.

Parks located on the Red River:

- Rivers Edge Park – Campground, boat launch and trail.
- LaFave Park – Fishing and trail use.
- Sherlock Park – Full facilities – swimming pool.
- River Heights Park – Picnic and playground facilities.
- Valley View Golf Course.

East Grand Forks Parks and Recreation Survey - This survey was conducted to assess the recreational needs of the community for future recreational facility planning and development. The survey was completed in February 1998.

Results of the East Grand Forks survey indicated that over 87 percent of the sample rated recreation as important to their quality of life. The top 10 recreational activities in which the respondents participated are (in order): 1) watching TV, 2) socializing with friends, 3) reading books, 4) walking for exercise, 5) bicycling, 6) church/religious activities, 7) movie theaters, 8) fishing, 9) playing video/computer games, and 10) attending plays or musicals.

A question at the end of the survey asked: “When the new dike alignments are completed, there will be a lot of additional open space created along the river. What ideas do you have for the use of this area?” Since this was an open-ended question, many ideas were suggested, from ball fields to townhouses. From the 112 responses, key words were identified, counted and recorded (key words were selected that fit into an outdoor recreation experience that could be part of the Corps of Engineers flood reduction project). The most popular key word was Park, followed by Green Space and Trees. Bike, Walking, Hiking, and Jogging Trails were mentioned as the second most important facilities. Other important recreational facilities listed were Campgrounds; Fishing Opportunities; Playgrounds; an Amphitheater, Event and/or Music Area; Cross-country Skiing; and Picnicking.

LAWCON FUNDED PROJECTS

The Land and Water Conservation Fund (LAWCON) is administered by the National Park Service to provide funds for local recreational development. Grand Forks received LAWCON grant money for four projects located within the flood reduction project area. They are the Central Park combination building, Lincoln Park playground and combination building, Lincoln Park golf course irrigation, and Sunbeam trail. Property acquired or developed with LAWCON funding cannot be converted to another use and must remain in public outdoor recreational use. Coordination has taken place with the National Park Service Grant Program Leader and the North Dakota Grants Manager. They have reviewed our recreation plans, and in their opinion, no negative impact on LAWON sites is expected. However, they recommend close coordination with the City of Grand Forks to ensure that any changes will not constitute a conversion of recreation land.

No Federal LAWCON funds were used for recreation in East Grand Forks. Instead, the State Grant Program, modeled after the LAWCON grant, provided facilities at O'Leary and Riverside Parks. These parklands must be maintained solely for outdoor recreation and made safe and accessible to the public. Close contact with the City is recommended as the flood reduction project is designed and constructed. Coordination through letters with a follow-up meeting to show the recreation plan to the Minnesota Department of Natural Resources took place in April and May 1998. After reviewing our recreation plans, the Minnesota Department of Natural Resources reached agreement that they will not require a formal appraisal or survey but want to identify replacement park within the Greenway. They will do this with coordination through the City of East Grand Forks.

North Dakota SCORP Information (1996-2000) - This State Comprehensive Outdoor Recreation Plan (SCORP) is a guide for developing and managing North Dakota's recreation base to determine future outdoor recreation priorities. The recreation survey indicated that Region 4 had a high participation rate, in order of importance, for Picnicking (62 percent), Pleasure Driving (58 percent), Walking/Jogging on paved trails (50 percent), Swimming (44 percent), Bicycling on paved trails (43 percent), Boating/Water-skiing (42 percent), and Golf (41 percent). The most needed facilities listed in Region 4, in order of importance, were Paved Biking Trails, Picnic/Playground Areas, Developed Campgrounds, Paved Walking/Jogging Trails, Swimming Pools/Beaches, Hiking Trails, Open Space Parks, and Historic Parks. North Dakota bicyclists want more trails, especially if they are paved. Over half the bicyclists thought adding signs, providing maps, and enhancing public awareness of trails and facilities would improve the bicycling climate. Over half of the respondents said they were interested in preserving wetlands.

Turtle River State Park, located in Region 4, was established in 1934 by the State Historical Society because of the large number of log and stone structures. Woodland Lodge, constructed along the river in 1938, is still used for family gatherings and park events. The Civilian Conservation Corps constructed the park. In 1995, the number of visits to the park totaled 124,380. The entire park is a nature sanctuary containing a rich diversity of wetlands, mixed hardwood stands, floodplain forest, timbered uplands and prairie areas. Turtle River State Park is located 22 miles west of Grand Forks on Highway 2. The 784-acre park offers Camping, Picnicking, Trails (interpretive, self-guided nature, bike, mountain bike (2.5 mile), horseback (rentals)), Fishing, Snowmobiling and 10K of groomed trails for Cross-country Skiing. Sections of the river

are stocked with rainbow trout in a cooperative effort with the North Dakota Game and Fish Department. Special programs are featured at the outdoor amphitheater.

Larimore Dam is a county water reservoir lake that offers fishing (limited motor use), camping, swimming, picnicking, and a nature study arboretum. Annual visitation is estimated at 100,000.

Minnesota SCORP Information (1995-1999) - This Minnesota State Comprehensive Outdoor Recreation Plan (SCORP) was prepared to surface recreation issues and strategies as a guide for developing and managing Minnesota's outdoor recreation. As recreation interests diversify and society becomes more complex, outdoor recreation issues increase. The SCORP identified six high-priority issues: 1) Sustainable Outdoor Recreation (environmentally sustainable and interdisciplinary approach), 2) Roles and Responsibilities (effective partnerships between providers – improved recreation programs), 3) Capital Investment (funding for acquisition, development, redevelopment, new programs and research), 4) Liability and Litigation (may limit recreation opportunities and increase costs), 5) Operations and Maintenance (funding constraints cause deterioration – liability and diminished quality of the recreation experience), and 6) Recreation Research (need information to effectively provide useful facilities and programs).

Outdoor recreation behavior and leisure patterns are changing, and identifying long-term strategies is necessary. The State's elderly population will increase nearly 70 percent as the *Baby Boom* generation enters middle age and its leisure choices influence recreation patterns. Many people today have a limited amount of leisure time, leading to a trend in recreation preferences: people tend to vacation more often, for shorter periods, closer to home. Changes in recreation patterns need to be monitored to determine shifts in participation that change for the *Baby Boom* generation, prior generations, the *Baby Bust* generation and upcoming generations. Shifting of recreation facilities use will have major implications for management. Since the leisure ethic remains strong in our culture, spending remains strong, and travel and tourism are important to employment and economics. Trends suggest that shifts in recreation preferences and expectations will provide strong competition for recreation dollars.

Old Mill State Park (300 acres) is approximately 40 miles northeast of East Grand Forks. The park accommodates campers, skiers, and snowmobilers, and conducts an interpretive program. The total number of visitors in 1990 was 28,996; in 1991 was 33,570; and in 1992 was 27,153. The Old Treaty Crossing Wayside Park is approximately 30 miles southeast on the Red Lake River. The Red Lake River is considered a recreational river for canoeing and boating.

The State's recreation economies rely heavily on an environmentally healthy land and water base. The quality of Minnesota's public and private lands and waters is increasingly degraded. This impact will seriously limit outdoor recreation opportunities if the trend is not reversed.

EXISTING FEDERAL RECREATION - Kelly's Slough National Wildlife Refuge is just west of Grand Forks, North Dakota, off U.S. Interstate 29 and U.S. Highway 2. This refuge (3,966 acres) was established in 1936 to be used as a refuge and breeding ground for migratory

birds and other wildlife. In addition to the refuge, Federal waterfowl production areas (3,400 acres) were purchased to promote the conservation of migratory waterfowl and to offset or prevent the serious loss of wetlands and other essential waterfowl habitat. Recreational facilities include an information kiosk, a wildlife observation deck, interpretive signs, a self-guided auto tour, foot trails leading to another observation deck, and parking. The managed wetlands and uplands offer exceptional bird watching opportunities year-round. Birdwatchers come from all over North America to catch a glimpse of the estimated 280 species.

The only Federal Management Unit in Minnesota that is near the project site is the Agassiz National Wildlife Refuge. It is not within the 50-mile area of regional influence since it is approximately 65 miles northeast of East Grand Forks, Minnesota.

RECREATION FEATURES OF THE PROPOSED PLAN

RECREATION DEMAND

The Park District in Grand Forks and the Parks and Recreation Department in East Grand Forks have long recognized that open space and parklands are a valuable resource to the community. A complete analysis of current local recreation supply and demand was completed and local surveys, SCORP information, public input during Greenway workshops, input from recreational professionals, and available State and Federal recreation was also accomplished. Multi-use trails lead the list of the most important facilities in shortage of supply that people use and request, with Parks and Picnic areas in second place (see the Recreation Appendix - Appendix G of the Supplementary Documentation for additional information about supply and demand in the study area).

Population Market Area

Population trends for Grand Forks and East Grand Forks were obtained from each city's Land Use Plan, dated 1996 and 1995, respectively. The cities are looking at a moderate growth pattern. Moderate growth is 0.9 percent for Grand Forks and 0.8 percent for East Grand Forks. The 1990 population figure is from the US Census. Projected growth using the 1990 population figures is not valid since the 1997 flood forced many people from their homes. Therefore, an assumption was made, in a recent news article depicting population losses after the 1997 flood, that the 1998 population figure will hold steady for about 5 years before any steady growth is realized.

Participation and Demand

Participation rates were derived from reviewing the North Dakota and Minnesota SCORP information, the recreation economic analysis prepared for Rochester Minnesota, local planning documents and surveys of recreational needs assessments.

The North Dakota SCORP identified the most popular activities in 1995 by listing participation for Walking/Jogging Paved Trails at 50 percent, Bicycling Paved Trails at

43 percent and Picnicking at 62 percent. The local area would like to see more winter sports and rated Cross-county Skiing trails as very compatible with using some bicycling and/or walking trails if the terrain is challenging. Grand Forks parks recorded picnic shelter reservations for 1996 (17,412 – party size). No other usage data was available to use in planning participation for the project. Participation rates were interpolated from earlier SCORP data to more recent SCORP data.

Participation rates are expected to rise slightly, based on the popularity of long distance bike touring, and the rise of walking for fitness for all ages, especially the aging *Baby Boom* population. Our aging population will have more time to recreate. Keeping physically fit is very important to this generation. The University of North Dakota and the University of Minnesota - Crookston enrollments are expected to remain stable. College students will continue to participate in Bicycling, Jogging and Cross-country Skiing. Cross-country Skiing trails can be provided on existing trails on overbuilt levee slopes and within the Greenway to satisfy moderately advanced skiers. Numerous miles of trails through interesting terrain and across bridges should provide a variety of trails that will accommodate local skiers who now travel to Bemidji, Minnesota. Bemidji is over 100 miles east of East Grand Forks. Bicycling, Cross-country Skiing, Walking/Jogging and Picnicking show an increase over a 50-year period to reflect more recent SCORP information.

The projected public use demand (in activity occasions) is calculated using recreation activity participation rates, population projections for the cities of Grand Forks/East Grand Forks, facility design capacities, and professional judgment. The years for depicting projected growth were chosen to reflect a 50-year project life. The annual activity occasions were converted to activity days (recreation days). This was based on the number of different activity occasions each recreational user would engage in during the day.

Annual Recreation Benefits

Table 11 shows the existing and projected recreation visitation over the life of the project for the activities that proposed recreation facilities will accommodate.

Table 11 - VISITATION (VISITOR DAYS)

<i>Year</i>	<i>Bicycling</i>	<i>Walking/ Jogging</i>	<i>Cross-Country Skiing</i>	<i>Picnicking</i>
2004	0	0	0	0
2005	157,040	193,536	30,240	27,200
2015	196,300	241,920	40,320	34,000
2035	237,680	370,181	50,400	40,800
2055	237,680	370,181	50,400	40,800

Benefit Computation

Recreation benefits attributable to the proposed trail system were based on projected unmet demand for facilities to accommodate the four recreational activities listed above. The demand estimates over the life of the project were used in conjunction with Unit Day Values developed for each of the four recreational activities. The value of the recreational activity in

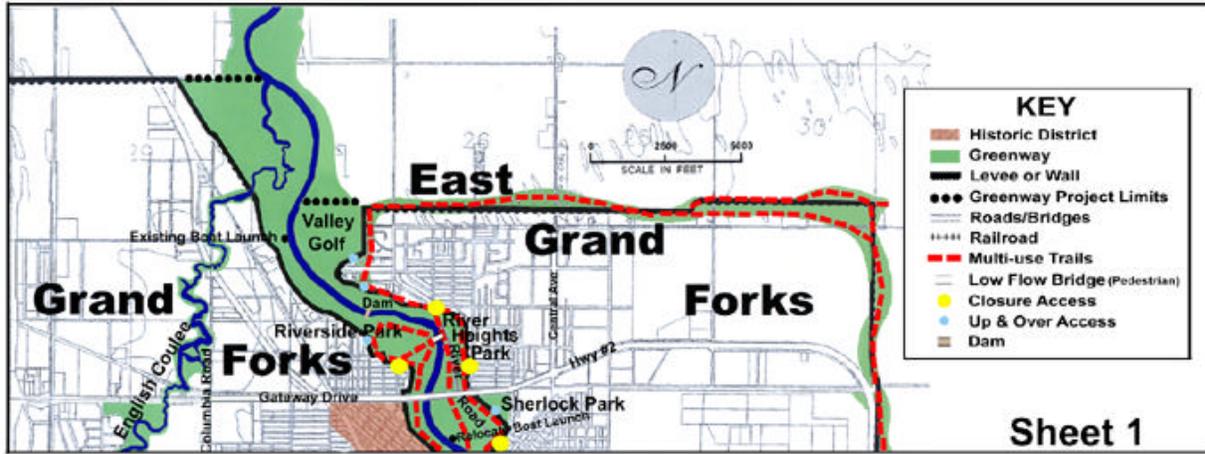
each project year was converted to a present worth value using a 7 1/4 percent annual interest rate. The sum of these present worth values, by recreational activity, was converted to an average annual dollar value, given a 50-year project life and a 7 1/4 percent annual interest rate. Demand in each project year was multiplied by the appropriate Unit Day Value for each recreational activity. The value of the recreational activity in each project year was converted to a present worth value using a 7 1/4 percent annual interest rate. The sum of the present worth values was converted to an average annual dollar value, given a 50-year project life. Average annual benefits for Bicycling, Walking/Jogging, Cross-country Skiing and Picnicking came to \$736,200, \$1,132,600, \$149,700, and \$112,100, respectively. The total average annual recreational benefits came to \$2,130,600.

Sheets 1 through 3 show the recreation concept plan proposed as part of the Federal flood reduction levee project. Identified on the concept plan are the levee or floodwall, multi-use recreational trails, three low flow bridges for bicyclists and walkers, and trail access points. Recreation trails are shown as a red dashed line, with low flow bridges in white. Openings through the levee are identified as closure access and are shown as yellow dots. The up-and-over-levee access points are shown as light blue dots. Grand Forks will have pedestrian closure access points at Riverside Park, Demers Avenue in downtown, Minnesota Avenue, Central Park, Lincoln Memorial Park, and Lincoln Park Golf Course. Up-and-over levee access will be provided at Alpha Avenue and North Third Street, Elmwood Drive, Belmont Coulee/Sunbeam Park, and the Sunbeam Park exit on 47th Avenue South. East Grand Forks will have pedestrian closure access points at River Heights Park on Eighth Avenue, Sherlock Park, O'Leary Park, and Folsom Park. Up-and-over levee access will be provided at Valley Golf Course, 19th Street, River Heights Park, Griggs Park, Timberline Court, Maplewood Addition, the Southwest Access and Highway 2. As an option to the non-Federal Sponsors, certain economically justified kinds of recreation features may be added to the recommended levees flood reduction project on a 50/50 cost-sharing basis. Generally, the recreation facilities are to be located on lands needed to implement the basic flood reduction project.

After careful coordination with the non-Federal Sponsors, it has been determined that recreation/Greenway development features are desired and are consistent with Corps guidance. Recreation facilities that can be cost shared as part of the project include the following: 1) Multipurpose Access and Circulation Trails, 2) Toilets and Shelters, 3) Utilities, 4) Public Telephones, 5) Site Preparation and Restoration, 6) Park Furniture, 7) Play Equipment, 8) Signs, 9) Interpretive Guidance and Media, and 10) Items for Protection, Control, Health and Safety.

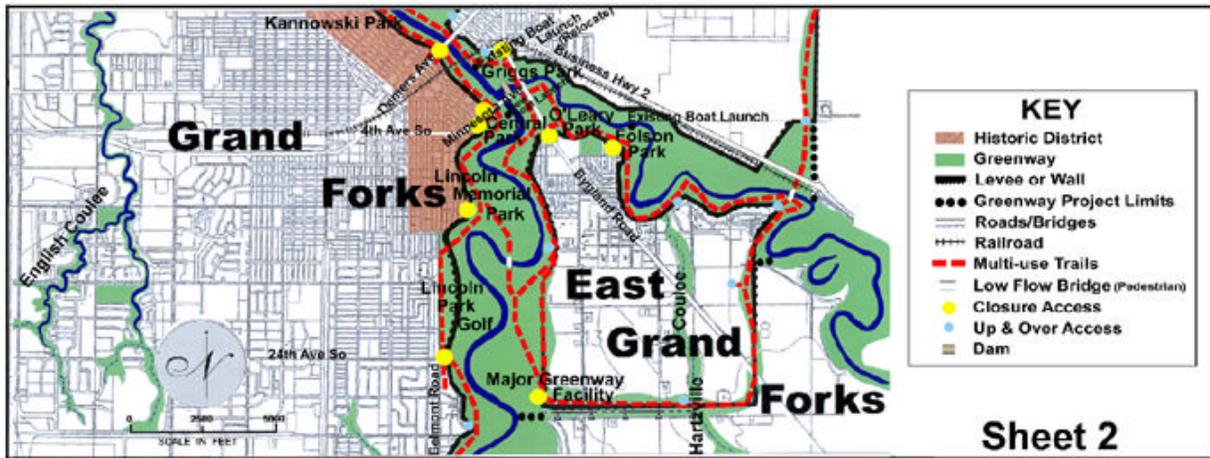
The recreation features to be implemented as part of the flood reduction plan will provide a framework for future Greenway development. The major focus of the recreation plan is to provide multipurpose bicycle/pedestrian trails, walking and jogging trails, cross-country skiing trails, and picnic facilities. Only multipurpose trails can be cost-shared by the Corps, consistent with Planning Guidance Letter 36 and Corps-wide guidance contained in Engineer Regulation 1105-2-100. Therefore, design and operation of separate trails for bicycles and pedestrian users is not allowed without being cost-shared as a betterment of the project. The trail use and associated betterments will be further coordinated with the non-Federal sponsors in future detailed design phases. Figures 7, 8, and 9 show the specific recreation features proposed as part of the Federal flood reduction levee project. For more details and plates presenting the recreation plan, see Appendix G of the Supplementary Documentation report.

Figure 7

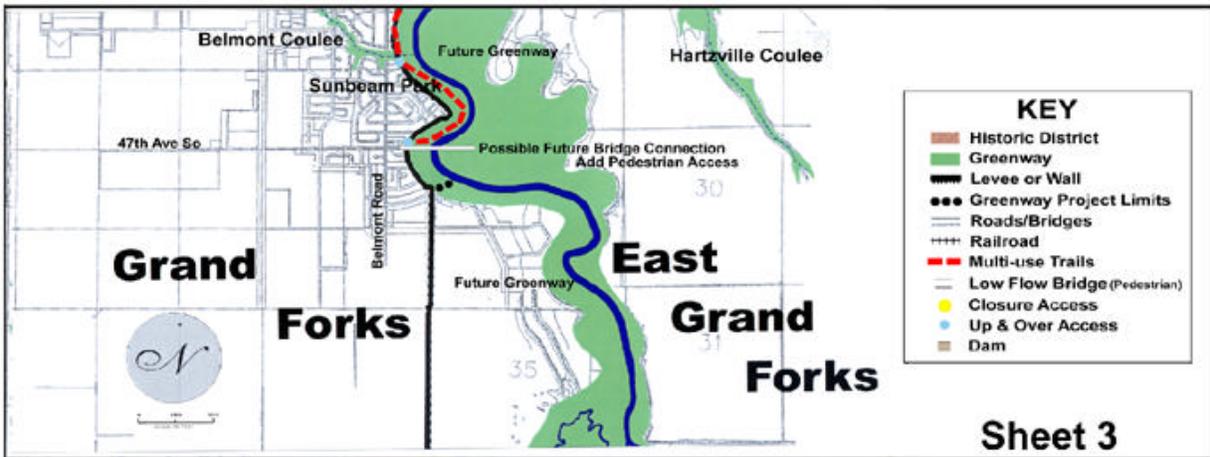


Recreation Plan Concept

Figures 8 and 9



Recreation Plan Concept



Recreation Plan Concept

Trails will be placed along the linear levee alignment on the west side of the Red River to provide a connecting trail from Riverside Park south to the Sunbeam area in Grand Forks. Approximately 14 miles of paved bicycling and walking/jogging trails will be built. In East Grand Forks, the trails will encompass the city in a surrounding greenbelt with a low flow bridge across the Red Lake River to connect both levee systems. Approximately 14 miles of paved trails and 10 miles of unpaved trails will be provided in East Grand Forks. Along the trails will be overlooks and rest stops. Trailheads will provide access to the levee trails and to the Greenway and will include support facilities such as parking areas, toilets, shelters, benches, signs, lighting, interpretive material, and trash receptacles. Picnic areas will have shelters, tables, grills, and trash receptacles at several parks and access to Greenway locations along the flood reduction project.

A boat launch in River Edge Park in East Grand Forks will be relocated to the Sherlock Park area. Two other boat launches are available, one at the north end of Grand Forks downstream of the dam and at Folsom Park in East Grand Forks. An additional boat launch upstream of the dam, requested by Grand Forks, is to be located in the Central Park area. The North Dakota Game and Fish Department has provided guidelines for locating boat ramps and shoreline angler access along the Red River of the North.

The historic Burlington Northern Railroad Bridge that crosses the Red River is used as a recreation trail connection between Grand Forks and East Grand Forks. The bridge receives high use from bicyclists, joggers, and walkers who use the bridge on a daily basis. This bridge is scheduled for removal in 1999 or 2000. To mitigate the functional impacts, pedestrians may use the sidewalk on both sides of the Demers Avenue Bridge. Other low flow bridge crossings will be available to cross the Red River between Riverside Park in Grand Forks and River Heights Park in East Grand Forks and between Lincoln Park in Grand Forks and the Greenway in East Grand Forks. A low flow bridge crossing will be available to cross the Red Lake River near the Maplewood Addition to the Greenway access point off Highway 2 in East Grand Forks. See Appendix G, Recreation, of the Supplementary Documentation report for additional details about the recreation plan/features of the recommended plan.

BENEFITS AND COSTS OF RECREATION FEATURES

A detailed benefit and cost analysis was done for the recreation development proposed as part of the Federal multipurpose flood reduction project. The first cost of constructing the proposed recreation facilities is estimated to be \$7,511,000, with an additional interest during construction cost of \$1,612,000. The annualized cost of local operation and maintenance is estimated to be \$337,000. These costs, when annualized, result in an annualized recreation cost of \$1,009,000. Recreation benefits associated with constructing the recommended plan were calculated to be \$2,130,600 annually. Therefore, the benefit-to-cost ratio for the separable recreation features is 1.90. This shows strong economic feasibility. See Appendix D of the Supplementary Documentation report for recreation feature cost details and Appendix G of the Supplementary Documentation report for recreation benefit details.

Effects of the Recommended Plan

On the basis of Corps of Engineers evaluations and public, interagency, and Local Sponsor inputs provided to this point in the plan formulation and environmental evaluation process, it appears that the overall social, economic, and natural effects of the recommended plan would be positive. From the local perspective, the most important effect of implementation of the recommended plan would be that thousands of homes, businesses, and public structures would be reliably protected from future floods and removed from the 100-year floodplain. It is important to note that the economic analysis done as part of this study claims only national flood reduction associated benefits. The recommended project would provide many long-term local and regional economic benefits that are not incorporated into the economic benefits attributed to the recommended plan but are very real and important to the community and its residents. These include improved community cohesion, preserved and improved property values and local tax base, enhanced recreation opportunities, improved aesthetics, improved public health and safety, and future enhanced community growth and development opportunities.

Areas of controversy have been identified as part of the National Environmental Policy Act scoping process. These areas of controversy include: 1) the need to take/relocate structures to implement the project; 2) the inability of the NED plan to include and protect some neighborhoods at the perimeter of the project alignments; 3) concerns about potential induced damages associated with implementing the plan; and 4) concerns about the adverse effects of the project on a number of historically significant structures. Most of these are short-term impacts associated with the unavoidable construction impacts of the project, and the effects are limited to impacts on existing land uses. These impacts include adverse effects to some existing historical structures and the unavoidable need to purchase and relocate a number of existing homes, apartments, condominiums, and businesses to allow for construction of the recommended levees and floodwall system.

An Environmental Impact Statement has been prepared to fully assess the impacts of the recommended project and obtain additional public and interagency comments. This Environmental Impact Statement is part of this General Reevaluation Report - main report.

Public and interagency inputs were sought on the widely distributed Draft General Reevaluation Report and EIS during a 45-day public open comment period that ended on October 5, 1998.

Areas of controversy were identified as a result of the Draft public review process. Noteworthy areas of concern by numerous commentors included:

- The desire to have special geotechnical design measures implemented to allow some levee alignments to be moved riverward to save existing structures.
- The desire of commentors to see basin-wide upstream storage alternatives further evaluated prior to implementing permanent levee plans.

- A number of commentors who are currently outside the area protected by the project want the project to be extended to protect their neighborhoods. They also contend that the project is adversely impacting the value of their property.

See the Environmental Impact Statement in this report for a complete listing of all public and interagency comments received on the draft report and the responding actions taken.

Based upon formal interagency and public comments and internal Corps review comments received on the draft report, a number of report clarifications and refinements were made to this final report. A final 30-day formal public open comment period and a final Washington Level Review will be held from 6 November to 7 December 1998. The refinements to the plan formulation that result from this ongoing coordination may alter project materials, design, cost, and cost apportionment or Federal participation in the project or any of its components.

Future Remedial Actions

Flood Reduction Measures Recommended

The recommended plan is not designed to protect against residual flood damages associated with very large floods. As a result, it is desirable – especially in an urban area like East Grand Forks/Grand Forks – to seek an additional increment of safety. This may be possible by pursuing basin-wide flood reduction solutions. These long-range flood reduction strategies are being coordinated through the International Coalition, the International Joint Commission, the Red River Basin Board, and other entities. The City Councils of East Grand Forks and Grand Forks have recognized the potential of these future studies. Other long-range strategies/measures that should be considered to further reduce the flood risk to Grand Forks and East Grand Forks include the following:

- Local, county, and township roads and future highways in the Grand Forks and East Grand Forks areas should be designed as secondary lines of flood defense against potential future levee overtopping and/or failure. The local governments can control and implement this measure. Over time, as Grand Forks and East Grand Forks continue to grow and replace or add to the existing infrastructure, this flood protection strategy should be planned for. The potential effectiveness of such measures can be seen in a related lesson of the 1997 flood. Specifically, in 1997, when the temporary sandbag levees gave way and were ultimately overtopped in East Grand Forks and Grand Forks, there was no way to protect most areas of the cities from near total inundation. However, in Grand Forks, structures on the west side of Washington Street were able to be protected after the initial sandbag levee failure and overtopping. This was possible because Washington Street was constructed at an elevation high enough to allow it to be raised quickly and thereby allow the road to act as a secondary/backup levee. This saved many structures from flooding.
- As new bridges are needed in the study area to serve a growing population and as existing bridges age, designing bridges so as not to obstruct river flows could provide an

increment of flood risk reduction. These bridges should also be designed to serve as multi-use transportation links that are strongly connected to the greenway system. This is a long-term strategy to be implemented after implementation of a Federal flood reduction project. The only bridge that is incrementally justified for removal as a feature of the flood reduction project is the existing pedestrian swing bridge. But, from an engineering perspective, it is possible to reduce flood stages if the existing bridges are removed or elevated in such a way as to improve hydraulic efficiency. However, it is also important to note that simply raising a bridge may not improve the hydraulic efficiency.

- Short-term flood reduction measures and planning should continue to be pursued. These plans are accomplished at the local level and will help to minimize the potential for short-term flood damages - prior to completing a permanent flood protection project. These local actions include: 1) Existing emergency flood fighting plans and features should be kept up-to-date, 2) national flood insurance should be purchased for all floodprone properties to help protect against future flood related losses, and 3) Consistent with Planning Guidance Letter No. 52 and the National Flood Insurance Program, East Grand Forks and Grand Forks need to prepare a revised floodplain management plans that accurately reflect changed physical conditions.
- Safety related betterments¹, such as increasing the height of proposed concrete floodwalls, should be considered by the non-Federal Sponsors in the construction phases of project implementation. Such betterments could improve future flood fighting capabilities. Another betterment that could provide an extra incremental of reliability for the recommended project would be the implementation of a boulder facing on the existing Riverside Dam. This would improve the stability of the existing dam and also provide valuable fish movement benefits.

Conclusions and Federal Recommended Plan

The 1997 flood demonstrated forcefully the need for a permanent flood protection project to protect East Grand Forks and Grand Forks. The current temporary levee systems that have been built to provide flood protection do not meet Federal standards and do not provide a certifiable level of protection. Recent flood events along the Red River have caused the existing flood insurance mapping to become outdated. When revised Flood Insurance Study maps are prepared for the Grand Forks and East Grand Forks area, almost the entire community will be located in the 100-year regulatory floodplain. This has many implications for the community and makes development of a permanent flood reduction project more compelling.

¹ Betterments are locally requested optional features that are not part of the basic Federal project. Betterments may be added to the project when the non-Federal Sponsor is willing pay 100% of the costs associated with such feature/s.

The recommended plan defined in this report consists of approximately 26 miles of permanent levees, floodwall, and road raises (these will ring both communities), two small diversion channels to direct the flows in the English and Hartsville Coulees out of town during flood events, riprapping of some river reaches, and removal of an existing pedestrian bridge. These features of the the permanent levee system recommended will provide both communities a 210-year level of protection (0.47 percent exceedance frequency flood event). This substantial and reliable flood protection for East Grand Forks and Grand Forks is important to implement from a local, State, and Federal perspective.

The recommended plan also provides for implementation of recreation features that will become the foundation for future development of a locally managed Greenway system. This multipurpose recommended plan is economically feasible (i.e., detailed economic and cost evaluations result in significant net benefits and the plan has an overall benefit-to-cost ratio of 1.10).

On the basis of public, interagency, and Local Sponsor inputs provided to this point in the plan formulation and environmental evaluation process, it appears that the overall social, economic, and natural effects of the recommended plan would be positive. However, areas of controversy have been identified as part of the National Environmental Policy Act scoping process. These areas of controversy include: 1) the need to take structures to implement the project; 2) the inability of the NED plan to include and protect some neighborhoods at the perimeter of the project alignments; 3) concerns about potential induced damages associated with implementing the plan; and 4) concerns about the adverse effects of the project on historically significant structures.

This General Reevaluation Report and Environmental Impact Statement will be distributed to interested local, State, regional, and Federal agencies and to the public for a second formal public comment period (Note: the draft report was previously distributed for a 45-day review which ended on October 5, 1998). After a final 30-day public and interagency open comment period on this final report, the St. Paul District, Corps of Engineers will document and consider all comments received. The finalized report and EIS will transmit the Chief of Engineers in Washington, D.C. for incorporation into a Chief of Engineers Report.

Further plan refinements will be conducted throughout the entire reevaluation phase. These refinements may alter project materials, design, cost, and cost apportionment or Federal participation in the project or any of its components.

RECOMMENDATIONS

I recommend approval of the recommended plan for local flood protection and associated recreation developments at East Grand Forks, Minnesota and Grand Forks, North Dakota, as presented in this report. This multi-purpose project is feasible from an economic, engineering, environmental, and social perspective. The recommended plan will provide reliable permanent flood protection for over 58,000 citizens located in Grand Forks and East Grand Forks and is an important step in the communities' recovery from the devastation of the 1997 Flood. The fully funded total cost to implement the recommended project features is \$350,431,000, of which an estimated \$174,349,000 would be a Local Sponsor's responsibility.

Kenneth S. Kasprisin
Colonel, Corps of Engineers
District Engineer